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Norway

Capital Goods

Commissioned Research

07 June 2024

Norsk Titanium

Transitioning from R&D to trusted Tier 1 supply chain partner

Initiating coverage

Fair value range:
NOK3.50–5.40

Share price:
NOK2.9

Modern and efficient production technology

Norsk Titanium (NTI) has developed a disruptive proprietary technology in additive manufacturing (AM) by creating a method for producing critical titanium components at significantly lower cost than the incumbents. The production process is faster, uses up to 75% less raw materials, up to 90% less machining time and 75% less energy, and is environmentally superior to the incumbents, according to NTI. After several years in the development phase, Norsk Titanium is the only AM company producing for both Boeing and Airbus, and we think it is now on the cusp of a substantial increase in serial production.

At the tipping point of becoming a trusted Tier 1 supply chain partner

We believe NTI is transitioning from the R&D phase to becoming a trusted supply chain partner, and the recent agreements with Boeing and Airbus are clear indicators that major aerospace and defence giants now accept NTI as a Tier 1 supplier.

Strong structural drivers

The high recent prices in titanium due to geopolitical turbulence, workforce shortages and strong structural demand trends for aircraft and defence spending are forcing the aerospace and defence industries to shift to new production processes. There is a strong need for more efficiency in terms of materials, energy and labour, areas where Norsk Titanium offers a superior solution to the incumbents.

Highly scalable business model

NTI is close to fully financed. We expect the current warrant issue to be fully exercised and current production capacity should support revenue of around USD300m in the future. The business model is highly scalable in our view, with limited capex needs, and can thus capitalise on a TAM of around USD100bn and Norsk Titanium's accessible share of 50%.

Fair value of NOK3.5–5.4

We initiate coverage with a fair value range of NOK3.5–5.4 per share. On our valuation metrics (regression across a large peer group), our fair value range implies 2026e EV/S and EV/EBITDA of 1.7–2.6x and 5.9–9.2x respectively.

Research analysts:
Örjan Rödén

Upcoming events

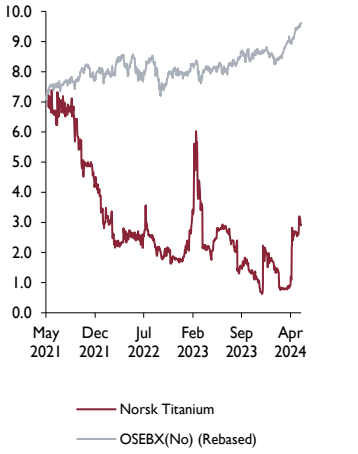
Q2 Report	28 Aug 2024

Key facts

No. shares (m)	790.0
Market cap. (USDm)	219
Market cap. (NOKm)	2,299
Net IB Debt. (NOKm)	-311
Adjustments (NOKm)	0
EV (2024e) (NOKm)	1,988
Free float	33.0%
Avg. daily vol. ('000)	5803
Risk	High Risk
Fiscal year end	December
Share price as of (CET)	03 Jun 2024 16:25

Key figures (USD)	2023	2024e	2025e	2026e
Sales (m)	3	14	43	151
EBITDA (m)	-23	-23	-11	44
EBIT (m)	-25	-25	-13	42
EPS	-0.10	-0.05	-0.02	0.04
EPS adj.	-0.10	-0.05	-0.02	0.04
DPS	0.00	0.00	0.00	0.00
Sales growth Y/Y	-23%	478%	196%	253%
EPS adj. growth Y/Y	-chg	+chg	+chg	+chg
EBIT margin	n.m.	-169.7%	-30.1%	27.5%
P/E adj.	n.m.	n.m.	n.m.	6.9
EV/EBIT	neg.	neg.	neg.	4.9
EV/EBITA	neg.	neg.	neg.	4.9
EV/EBITDA	neg.	neg.	neg.	4.7
P/BV	neg.	6.3	9.9	4.1
Dividend yield	0.0%	0.0%	0.0%	0.0%
FCF yield	-10.9%	-12.3%	-10.2%	3.2%
Equity/Total Assets	-6.1%	64.2%	47.0%	55.1%
ROCE	-186.0%	-114.7%	-45.0%	108.7%
ROE adj.	-325.9%	-144.2%	-45.0%	83.7%
Net IB debt/EBITDA	-0.2	1.3	0.7	-0.3

Share price -5Y



High/Low (12M) NOK3.2/0.6

Perf.	3M	6M	12M	YTD
Abs.	243.2	174.2	3.6	34.9
Rel.	230.9	167.3	-14.7	17.9

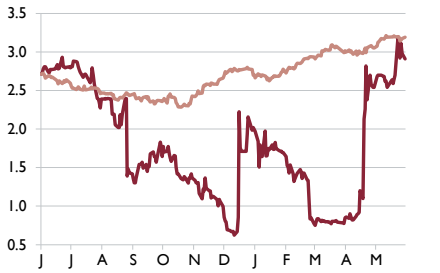
Source: Carnegie Research, FactSet, Millistream & company data

Performance & valuation

Price relative to market – 1Y

Source: FactSet

Price relative to sector – 1Y



Source: FactSet

Major shareholders

Shareholders (%)	Capital	Votes
White Crystals LTD	28.2%	28.2%
Scatec Innovation AS	18.0%	18.0%
Triangle Holdings LP	11.9%	11.9%
Disruptive Innovation Fund L.P.	6.8%	6.8%
Norsk Titanium Cayman Limited	5.4%	5.4%
MP pensjon PK	3.2%	3.2%

Source: Holdings

Company miscellaneous

CEO	Carl Johnson
CFO	Ashar A Ashary
IR	Ashar A Ashary
Phone	+47 97 42 22 00
Web	www.norsktitanium.com
Address	Flyplassveien 20
City	Hønefoss

Source: Carnegie Research

Company description

Norsk Titanium is an innovative Norwegian company, formed in 2017, which has developed a proprietary disruptive technology within additive manufacturing. Through its patented RPD (Rapid Plasma Deposition), Norsk Titanium can produce critical structural titanium parts at significant lower costs compared to incumbents. Moreover, the production process is faster, uses significantly less raw materials, uses less energy and is environmentally superior compared to the incumbents. After several years in developing phase, the company is now having serial orders to the aerospace and industrial customer segments.

Source: Carnegie Research & FactSet

Contents

Investment case summary

At the inflection point from R&D to a trusted Tier 1 supply chain partner

Norsk Titanium is an innovative additive manufacturing (AM) company in Norway with its main production facilities in Plattsburgh, NY. The company has developed a disruptive proprietary technology that can produce titanium parts at a lower cost than incumbents, at the same levels of quality. The products have the forging specification that is crucial in product specification in Nork Titanium's customer segments, e.g. aerospace and defence. Norsk Titanium was formed in 2007 and has received over USD400m in funding over its lifetime. Norsk Titanium's technology – Rapid Plasma Deposition (RPD®) − uses a plasma torch to melt a titanium wire and build products 'drop-by-drop'. Norsk Titanium's foremost target markets are the aerospace and defence industries, which are both characterised by heavy regulation and extensive qualification processes. Norsk Titanium is the only AM company that produces for both Boeing and Airbus. Norsk Titanium is, according to our estimates, close to being fully financed. We expect the upcoming exercise of warrants to be successful and to make the company fully self-financing, according to our estimates.

Impressive customer list

The company has already landed several notable customers, including Airbus Aerostructures, Boeing, Spirit AeroSystems, Aerotec, Northrop Grumman, General Atomics and ASML/Hittech. Such a list is, in our view a strong indication of market acceptance and thus the commercial viability of Norsk Titanium's offering.

Recent announcements with OEMs spells credibility

Recent announcements, e.g. the agreement to deliver parts in serial production directly to Boeing and the long-term master agreement to supply parts for the Airbus 350, mark an inflection point in the company's history, in our view. For many years, NTI has been in R&D and qualification mode, with limited revenues and a high burn rate. However, these agreements, together with supply agreements to e.g. Hittech in the semiconductor industry, mark an inflection point away from R&D and qualification to becoming a trusted supply chain Tier 1 partner to the major players in commercial aerospace. The company has for a long time focused on industrialisation, automation and testing, and should be able to gain real traction in sales and profits from this commercialisation, in our view.

Exposure to the semiconductor industry

Norsk Titanium has made important inroads in the semiconductor industry, delivering carrier trays to ASML/Hittech, with scope for increasing volumes from ASML. Exposure to the semiconductor industry implies less dependence on the aerospace and defence industries and offers strong growth prospects given the high growth projections for semiconductor production on the back of further digitalisation of the economy.

Incentive to shift production to resource efficient technologies

The rising price of titanium due to geopolitical turbulence and strong structural demand trends for aircraft and defence spending is forcing the aerospace and defence industries to increase their efficiency in materials, energy and labours, areas where Norsk Titanium offers a superior solution. Using Norsk Titanium's products also saves some 30% in CO2 emissions relative to the traditional process, according to NTI estimates, which is a strong USP when the commercial aerospace industry, in particular, is under pressure to reduce its greenhouse gas emissions.

The price of titanium metal is rising and supply is a challenge, while the price of titanium sponge has risen double-digit since 2020 in the US. We believe geopolitical turbulence – in 2023 260,000mt of titanium metal was produced in China and 46,500Mt in Russia, out of a global total of 410,000mt – is forcing many buyers to source from other countries, which is driving up prices in the US.

Titanium metal is gaining share in aerospace and defence

There is a clear trend towards structural growth in titanium products relative to other materials used in aerospace and defence. More complex materials such as composites create corrosion with the traditional metal used, aluminium. Titanium has several competitive advantages such as high strength and low weight, while not sharing some of the disadvantages of aluminium. The main obstacle to increased use of titanium is difficult machining conditions and the supply of titanium metal, a drawback that Norsk Titanium's RPD™ process is able to overcome.

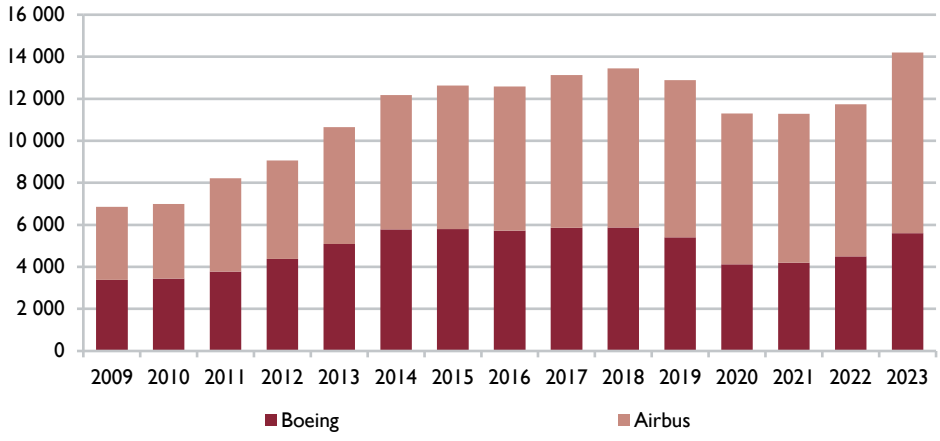
We see limited competition today, but it will probably emerge later

Today, we see limited competition from other AM companies. Potential competitors can be divided into powder-based and wire-based technologies. Powder-based manufacturing has significant disadvantages due to porosity and major quality issues. Potential wire-based producers lack steady and large-scale production and are likely two to three years behind Norsk Titanium on qualification and documentation of the production process and product quality. The difficulty of achieving qualification in the aerospace and defence industry should not be underestimated, given the high financial and reputational risk involved in potential accidents. Over time competition is likely to arise, but given the strong market backdrop and the competitive advantage of wire-based AM production technology over the traditional production process, we see a sweet spot in the next few years in which NTI is able to gain a foothold in the significant parts market for the aerospace and defence industry before competition catches up.

Cyclical tailwind from rising commercial aircraft backlogs

Norsk Titanium's commercial proposition is structurally strong in the current challenging environment. We believe the strong market backdrop offers further cyclical support for NTI's ability to become profitable. Rising fleet backlogs at the big commercial aircraft OEMs Boeing and Airbus and strong recent financial performance from traditional, titanium-focused sub-suppliers both encourage the OEMs to be open to new entrants that can challenge the strong market position of the incumbent suppliers, in our view. We believe the aerospace and defence industry needs to improve supply chain efficiency in order to handle challenges such as environmental footprint and product quality.

Backlog # commercial aircrafts



Source: Company Data., Carnegie Research

OEMs likely to back new entrants given strong demand

We believe Norsk Titanium can achieve an EBITDA margin of close to 30% in the near term, i.e. in 2026e, as the OEMs look to encourage greater competition and exploit the cost saving potential from using AM technology. However, in the long term, we expect NTI's EBITDA margin to converge towards main incumbent Howmet's 23% in 2023.

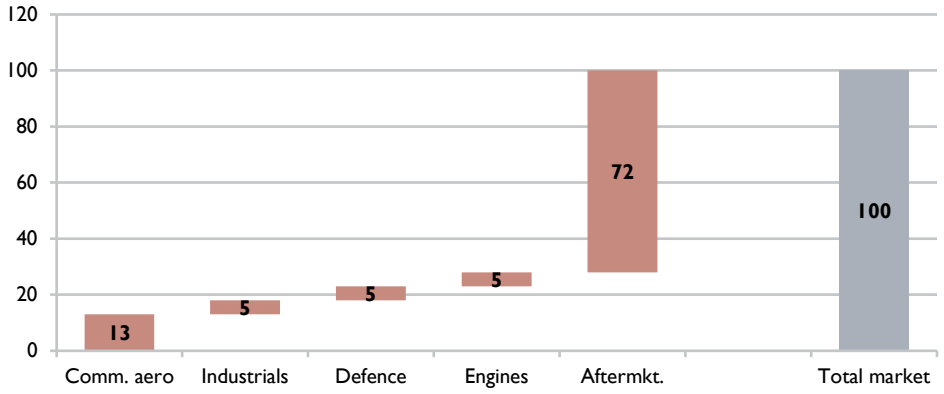
At the crossroads of 3D printing and software

Norsk Titanium is at the crossroads of AM technology (or metal 3D printing in layman's terms) and software, which places it at the forefront of a modern production landscape. The company has invested in its propriety software and can achieve fast turnarounds from customer specification to near net-shape parts fast, which is a key competitive advantage in our view.

TAM of USD100bn

According to Norsk Titanium, the TAM for titanium parts – based on the end-user price – is USD100bn, with commercial aerospace, NTI's most penetrated market in the near term, accounting for USD13bn of the total.

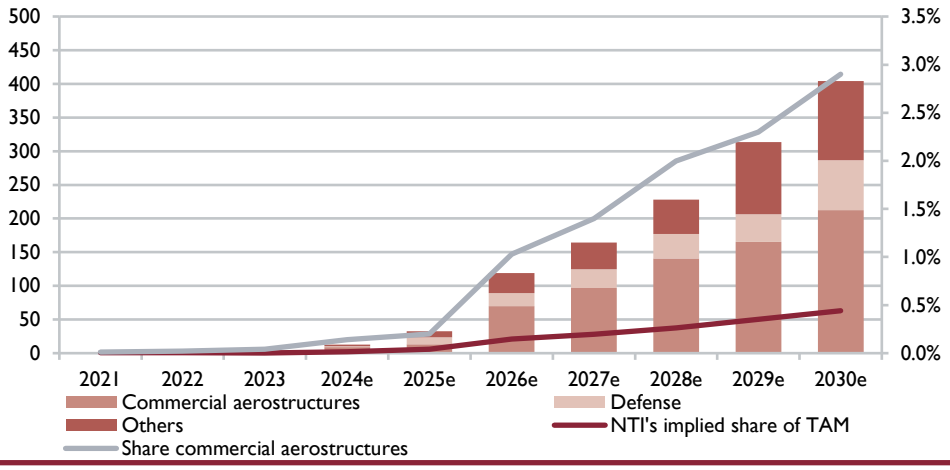
Titanium parts - TAM for NTI's RPD technology - USDbn



Source: Norsk Titanium, Carnegie Research

Norsk Titanium produces near-net-shape parts, so the relevant market is approximately USD50bn. In 2026 we expect revenues of USD151m. Based on the relevant TAM this implies an insignificant share of the total market.

Norsk Titanium revenues (USDm) and share of TAM



Source: Carnegie Research

Estimates – substantial revenue in 2024 and significant growth thereafter

Over the next two years, NTI's revenue should start to increase rapidly to reflect serial production in the commercial aerospace and industrials markets. The company retains the possibility of moving into serial production in the defence market too. We factor in that Norsk Titanium is well into serial production with clients such as Airbus Aerostructures, Boeing and Hittech, a sub-supplier to ASML, and expect further rapid growth as RPD® becomes increasingly recognised in the market and the above-mentioned clients can act as strong reference customers, thereby allowing the product to gain market traction.

Today NTI's cash burn rate is around USD20m/year, and we expect the recent capital accumulation, together with a successful exercise for the upcoming warrant windows, to be sufficient for the company to reach cash flow break-even. Norsk Titanium is currently capital light and its capex needs are limited for the next 7–8 years in our view, as our estimates imply an operating rate below 50% over the next few years.

Going forward, we expect continued strong growth, supported by contracts for more and larger parts, and generally continued traction and wider acceptance in the industrial and service markets. We believe 35% top-line growth is possible in the medium term, i.e. until 2029, and that that growth will moderate thereafter to ultimately reach the mid single-digits. This scenario, together with our estimate of an EBITDA margin of close to 30% in 2026e, and 25% from 2027e, forms the basis for the high end of our fair value range.

Ample capacity to grow

Current installed capacity supports revenues of about USD300m, double our 2026e estimate, and the business is scalable with limited capex, in our view.

Significant forecasting risk warrants an alternative scenario

Given that Norsk Titanium is on the brink of leaving the R&D phase to scale up serial production, forecasting risk is significant. Small delays in the ramp up process would probably have a high impact on revenues, and therefore earnings, given the significant operational leverage. Until serial production is established, and recurring revenues are clearly visible, the risk of short-term setbacks is always present. While we currently see no reason to expect a slower ramp-up than what the company indicates, we cannot rule out such scenario. Potential sources of delay to ramp-up can be attributed to specific aircraft models, e.g. the problems with the Boeing 737 Max, or geopolitical and macroeconomic events triggering a slowdown in demand in Norsk Titanium's end markets.

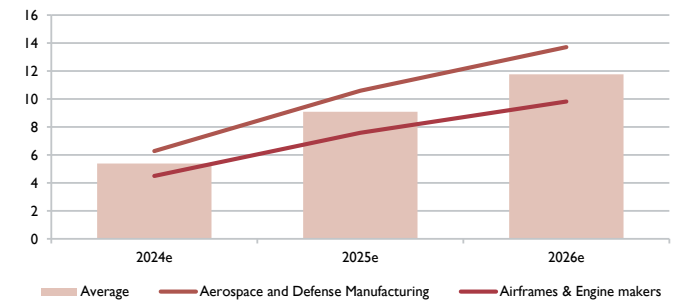
We have therefore created an alternative ramp-up scenario, where NTI is able to grow at a lower, but still impressive rate of 20% per year. In this scenario we see Norsk Titanium reaching EBITDA breakeven in 2026e, versus our current estimate of close to a 30% EBITDA margin in 2026. This scenario forms the basis for the low end of our fair value range.

Valuation: fair value range of NOK3.5–5.4

Our fair value range is based on a regression model with a large peer group. At our fair value range, the shares would be valued at EV/S of 1.7–2.6x, EV/EBITDA of 5.9–9.2x and EV/EBIT of 6.2–9.6x, respectively.

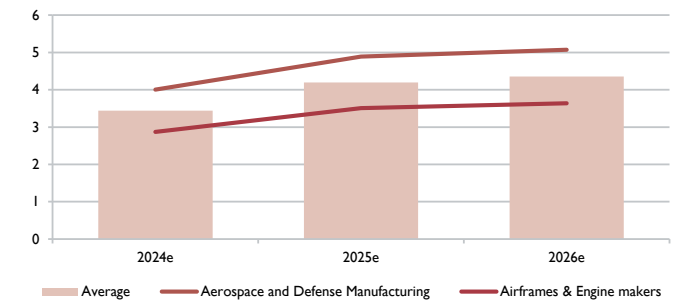
Our fair value range is based on a regression model that it itself based on EV/S versus revenue CAGR and EBITDA margin across two large peer groups: aerospace & defence manufacturing and airframes & engine makers. At the high end of our fair value range, we compare our estimates for Norsk Titanium's CAGR sales and EBITDA for 2026e and apply the derived EV/S multiple from the regression model. At the low end of our fair value range, we have used our slower ramp-up scenario in 2024–26e period and applied that to the same EV/S multiple derived from the regression model. The charts below show the different scenarios and how the fair value would evolve if the peer group valuation were to remain unchanged and our estimates prove correct.

Implied value/share based on regression, high end of FV range



Source: Carnegie Research

Implied value/share based on regression, low end of FV range



Source: Carnegie Research

On our fair value range the valuation implies the following metrics (see the Valuation section for complete lists of the companies that make up our two peer groups):

EV/Sales	2024e	2025e	2026e
Aerospace and Defense	1.9	1.7	1.6
Airframes & Engine makers	1.6	1.4	1.2
Norsk Titanium	**2024e**	**2025e**	**2026e**
Fair value, low 3.5	18.2	5.5	1.7
Fair value, high, 5.4	28.1	8.8	2.6

Price. date: 2024-06-03 *Source: Factset, Car. Res.*

EV/EBITDA	2024e	2025e	2026e
Aerospace and Defense	15.5	11.4	9.8
Airframes & Engine makers	12.2	9.7	8.8
Norsk Titanium	**2024e**	**2025e**	**2026e**
Fair value, low 3.5	N.m.	N.m.	5.9
Fair value, high, 5.4	N.m.	N.m.	9.2

Price. date: 2024-06-03 *Source: Factset, Car. Res.*

EV/EBIT	2024e	2025e	2026e
Aerospace and Defense	16.2	14.4	13.1
Airframes & Engine makers	15.0	13.0	11.6
Norsk Titanium	**2024e**	**2025e**	**2026e**
Fair value, low 3.5	N.m.	N.m.	6.2
Fair value, high, 5.4	N.m.	N.m.	9.6

Price. date: 2024-06-03 *Source: Factset, Car. Res.*

We take a five-year view on our multiple valuation, creating a sensitivity table with different sales levels relative to our 2029 projection and the implied share price:

	Implied share price today based EV/Sx 1-4 & 15% CoE							
Sales projection 2029e, USDm	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**
290	1.0	1.9	2.9	3.8	4.8	5.7	6.7	7.7
390	1.3	2.6	3.9	5.2	6.4	7.7	9.0	10.3
490	1.6	3.2	4.9	6.5	8.1	9.7	11.3	12.9
590	1.9	3.9	5.8	7.8	9.7	11.7	13.6	15.6

Source: Carnegie Research

Norsk Titanium at a glance

Norsk Titanium is a leading additive manufacturing company that specialises in the production of critical structural titanium components for the aerospace and defence sectors, as well as industrial sectors such as the semiconductor industry. The company was founded by Dr Alf Bjørseth and Petter Gjovad in 2007. Over 17 years of research and through over 190 patents, the founders were able to develop the Rapid Plasma Deposition® (RPD) technology that – through 3D printing – can produce complex metal products at an industrial scale through their MERKE IV machine. The advantage of the RPD® process is that it considerably reduces machining, waste in input-to-final product, energy consumption and lead time, relative to the conventional forging industry.

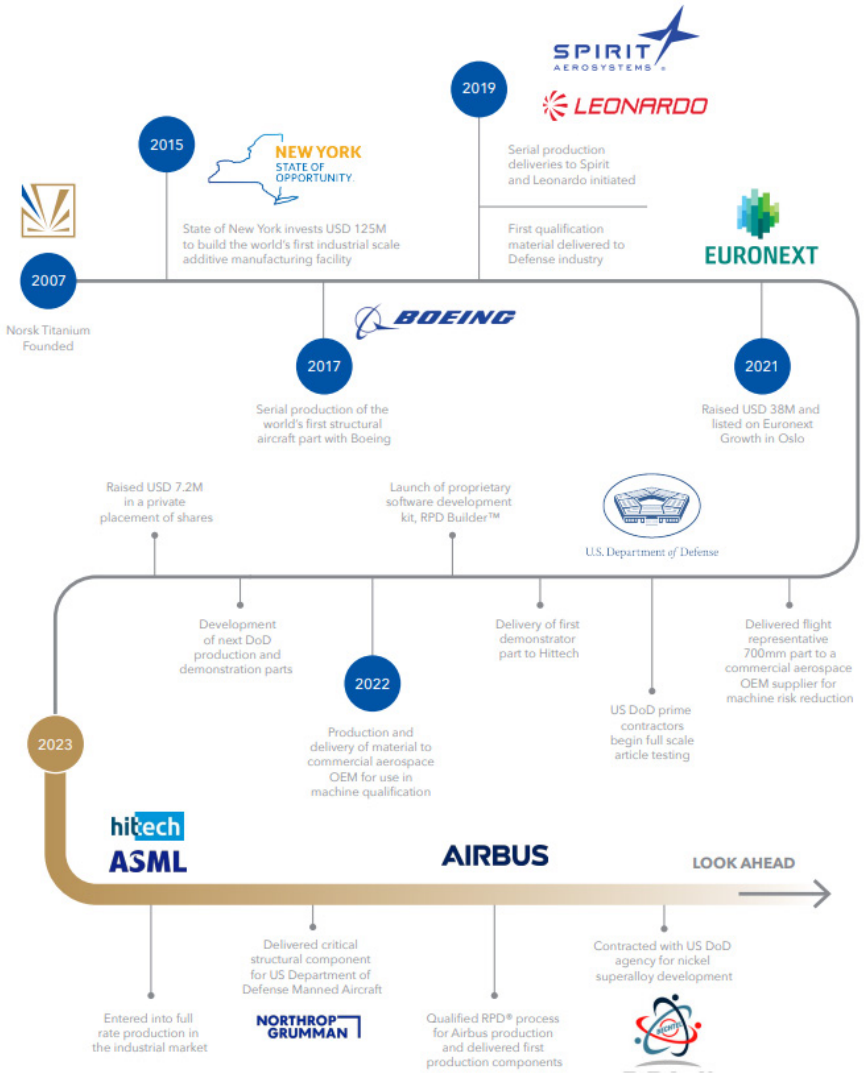
The company currently caters to highly specialised industries, such as the commercial aerospace and defence industries or semiconductors, due to the inherent advantageous properties of titanium for specialised parts, as well as the effectiveness of Norsk Titanium's production process. While the company is now focusing on titanium-related production, its RPD® technology is also applicable for other metals and alloys and can therefore meet the demand of other industries, including chemicals, automotive and the health sector. The company is at an inflection point and is currently undergoing a transition from the R&D and qualification stage to becoming a credible Tier 1 supply chain partner, as OEMs gradually finalise the qualification process for Norsk Titanium's products and move into longer-term supply contracts.

Company history and product development

Norsk Titanium was founded by Dr Alf Bjørseth and Petter Gjovad in 2007. In 2017, it became the only titanium AM producer to receive approval from the Federal Aviation Administration (FAA) to produce critical structural parts for the commercial aerospace industry, specifically the Boeing 787 Dreamliner. Today it is the only AM with qualifications and material specifications with Boeing and Airbus.

Since inception, Norsk Titanium has obtained strategic investments from notable companies such as Scatec Innovation, Aljomaih Group, Alcoa (now Howmet), Applied Materials venture fund, Fortress Investment Group and Rose Park Advisors. The company has to date received ~USD400m in total funding. Notably, in 2016, the firm obtained USD125m of funding from the State of New York through the Fort Schuyler Management Corporation for construction of the Plattsburgh Production Centre. The programme funded two production facility sites and 32 out of Norsk Titanium's 35 RPD® machines. The investment accelerated the group's commercialisation of its products and technology. In return, the group has committed – on a best-efforts basis – to employ individuals in the local area as well as create jobs going forward. The agreement lasts for 10 years following receipt of a Certificate of Occupancy, which occurred in March 2020. The financial impact is favourable, Norsk Titanium is leasing the machines for USD1 annually until 2030.

Norsk Titanium timeline



Source: Norsk Titanium

The commercialisation of the group's technology began in 2008, when its first prototype machine became operational. Since then, its MERKE IV and RPD® technology have completed four phases, and in 2015/16 the company debuted the RPD® process, and in 2017 delivered the first MERKE IV machines to the Plattsburgh Production Center.

Nordic Titanium – selected events

Year	Selected events
2007	Company is founded by Dr. Alf Bjørseth and Petter Gjovad
	Investment by Scatec Innovation (Nti Holding AS)
2008	First prototype machine operational
2009	Cooperation agreement signed with Spirit AeroSystems
	Second prototype machine operational
2010	Cooperation agreement signed with Airbus
	Investment by Aljomaih Group
	NORSOK (oil and gas industry) certificaiton achieved
2011	Patent "Method for Production of Alloyed Titanium Welding Wire" published
	Commercial manufacturing to the oil and gas industry
2012	Third prototype machine operational
	Patent "Method and Device for Manufacturing Titanium Objects" published
2013	The Group and Spirit Aero reach technology level six, demonstrating the ability to meet airspace material requirements
2014	Spirit Aerostructures TRL8 FAA material successfully manufactured
	Patent "Method and Arrangement for Building Metallic Objects by Solid Freeform Fabrication" published
2015	USD 125m agreement with state of New York
	Boeing approved supplier
	Strategic investment by Howmet
	Production RPD machines come online; each machine can produce 10-20 Mt of titanium parts/year
2016	Ship prototype parts for Airbus A350 XWB to Premium Aerotec
	Investment by Applied Materials venture fund
	The Group debuts the RPD process and Metal Additive Manufactured Aircraft Components
2017	The company delivers MERKE IV RPD machines to Plattsburgh, New York
	Creation and delivery of first 3D-printed, FAA-approved structural aircraft part to equip the Boeing 787 Dreamliner with titanium components
	Investment by Fortress Investment Group
	Strategic investment by Rose Park Advisors
2018	First AD integrally bladed rotor delivered to Pratt & Whitney for test
	1st Spirit Aerosystems delivery
2019	1st part qualification using OEM material allowables
	1st delivery of production parts from Plattsburgh Development and Qualification Center
2020	1st Leonardo delivery
	1st consumer electronics development effort
	NYS completed construction of Plattsburgh Production Center
	1st defense development test part printed
2021	Listed on Euronext Growth in Oslo
	1st delivery of production parts from Plattsburgh Development and Qualification Center
2022	Hittech demonstrator part and first production order awarded
	Completion of a qualification test program with Northrop Grumman
	Norsk Titanium's machines at PPC were appoved for Boeing production
2023	Innovation Norway awarded a NOK35m (around UISD4m) grant
	Norsk Titanium was awarded a serial production order from Hittech for production of a large 100kr carrier tray
	Extensive qualification effort with General Atomics unmanned aircraft systems
	The company received a follow-on order for delivery of additional carrier trays to Hittech
	Norsk Titanium's machines at PPC were appoved for Airbus production
2024	Norsk Titanium develops nickel based superalloy for US navy applications
	Hittech award Norsk Titanium a two-year supply agrrangement for silicon wafer carrier trays
	Norsk Titanium enters into long-term master supply agreement with Airbus
	Norsk Titanium signs agreement with Boeing for serial production
	Norsk Titanium announces full rate production order in the semiconductor market

Source: Norsk Titanium

The company currently operates out of Plattsburgh, New York, which is its industrial scale production centre, and Hønefoss, Norway, which is NT's main R&D centre. The company owns 35 RPD® machines, with a production capacity of 700Mt per year. Norsk Titanium's main production facility in Plattsburgh, New York is the world's largest 3D printing facility by production capacity.

Sites and resources

Overview of Group's manufacturing and R&D facilities

Location	Plattsburgh, New York, USA	Eggemoen, Ringerike, Norway
Number of employees	52	64
Number of RPD machines	32	3
Capacity	620 MT / year	80 MT / year
Function	Manufacturing, qualification	Manufacturing, R&D

Source: Carnegie Research, Norsk Titanium

Pictures of sites

Source: Norsk Titanium

Customers and achievements

Norsk Titanium is supplying structural grade titanium components to important aerospace players, including Boeing, Airbus, Spirit and Leonardo. In recent years the company has made important inroads into the industrials market, in particular the semiconductor industry, serving clients like Hittech and the end-customer ASML.

In 2009, the company signed its first cooperation agreement with Spirit AeroSystems. By 2013, Norsk Titanium had reached a milestone for Direct Metal Deposition Technology by achieving technology readiness level six, demonstrating its ability to meet aerospace material requirements. In 2018, Norsk Titanium made its first delivery to AeroSystems.

In 2010, Norsk Titanium signed a cooperation agreement with Airbus. The group also signed a framework agreement with Airbus covering qualification and production of RPD® components. There are currently four parts in qualification for the A350 programme, with machine process qualification funded and underway.

In 2015, Norsk Titanium became a Boeing Approved Supplier. In 2017, it became the first FAA-approved structural aircraft part producer to equip the Boeing 787 Dreamliner with RPD® titanium components.

In 2020, Norsk Titanium made its first Leonardo delivery and printed its first defence development test part.

In 2023, Norsk Titanium produced structural additive titanium preform for client General Atomics, thereby making inroads into the US defence market. In 2024 final machined components were delivered.

In February 2024, Norsk Titanium announced the development of Inconel 625, a nickel-based alloy for US Navy applications.

In April 2024, Norsk Titanium entered into a long-term master supply agreement with Airbus Aerostructures.

In April 2024, Norsk Titanium signed a direct supply agreement with Boeing for serial production.

The table below outlines Norsk Titanium's customers, which we find quite impressive.

Sample of NTI's customers

Source: Nork Titanium

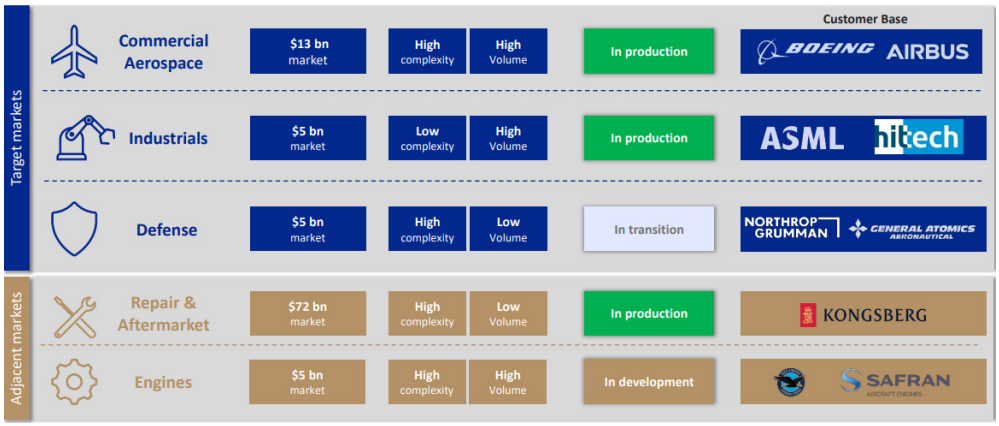
Norsk Titanium's strategy going forward

The company has until now been in a development phase with small serial production and limited commercial availability. We believe this is about to change, as the company can enter full-scale commercial production as it has now received full qualification from OEMs for its components.

Given the recent, important supply agreements with Airbus and Boeing, we think Norsk Titanium is entering a completely new phase. From now on, its focus is to increase the industrialisation and automation of its processes, thereby increasing volume serial production and revenues, leading to cash flow and self-sustainability – at least that's the plan. We see the company as in a unique position relative to new technology companies; a trusted Tier 1 supply chain partner with tangible contracts with the commercial aircraft majors Boeing and Airbus.

Norsk Titanium's main market is currently the commercial aerospace sector. While this is set to remain an important market going forward, the company has also entered the industrials market, namely the semiconductor sub-supplier industry, and plans to expand into the defence market in the near future too:

Norsk Titanium's go-to-market strategy



Source: Norsk Titanium

RPD® as a disrupting technology

Rapid Plasma Deposition delivers all the benefits of 3D printing while achieving forging quality at an industrial production scale. This is extremely important as forging quality is a prerequisite for deliveries to the aerospace industry. By significantly reducing input-to-final-product waste, allowing far less machining and supporting lower lead times and energy consumption, RPD® could revolutionise the forging market in the coming years.

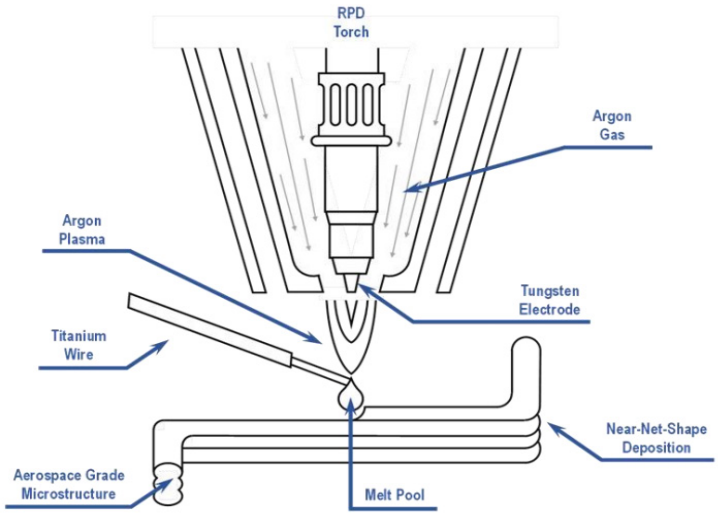
What is additive manufacturing and RPD®?

The additive manufacturing (AM) market is an emerging computer-controlled production technique that creates three-dimensional objects by depositing materials, usually layer by layer. This stands in contrast to the incumbent industry which starts with a metal block and reduces excess metal until the final shape is created. There are a multitude of AM production techniques that trade off quality, efficiency and final product size in production. We will examine the relevant technologies in a later chapter. Norsk Titanium's RPD® process is a new production approach that aims at minimising the trade-off between these production aspects.

In essence, the RPD® process revolves around making the production of metal components quicker and more cost effective, using less raw material, than traditional milling and forging production techniques.

The starting point for the production process is a traditional CAD drawing – a detailed 3D illustration of the product – or solid model of the desired component. Then, through the RPD® process a titanium wire is melted at very high temperatures by the RPD® torch in an atmosphere of argon gas. The use of argon gas is imperative as it shields the material from contamination that can cause embrittlement, which reduces the integrity of the material. After the titanium has been heated to its melting point, the material is added drop by drop in subsequent layers to create a near-net-shape part. During the process, a machine runs a quality assurance programme over 600 times per second. In doing so, the machine significantly reduces machine work. It also ensures that the final product holds the same level of quality as the forging industry when producing at the highest level of quality.

The RPD technology production process



Source: Norsk Titanium

The group's RPD® manufacturing processes is enabled by the MERKE IV machine. MERKE IV is the group's 4th generation RPD® machine and can deliver industrial scale 3D printing. MERKE IV transforms titanium wire into complex components suitable for structural and safety-critical applications. Depending on part size and geometry, each MERKE IV machine can produce 10−20 metric tons annually.

The MERKE IV machine

Source: Norsk Titanium

Norsk Titanium's business is also supported by a strong technology platform. Beside its patents, the company has many years of production history that provide data for future engineering and production challenges. Norsk Titanium also has terabytes of data support qualifications and full part lifecycle traceability which can support future qualification rounds.

Norsk Titanium versus the incumbent industry

The history of metal forging is long, with many incremental improvements introduced over hundreds of years. These changes relate to the quality that traditional forging can achieve in products. Forging achieves superior quality through repeated 'working' of the base material, enabling homogenous traits and quality through the material in every batch produced.

Until recently, no competing processes emerged that could challenge the quality and consistency of this industry and maintain the inherent qualities of metals from production start to end. Industries that require metal components that can withstand high temperature and stress have until now not wanted to risk sourcing these parts from non-conventional producers.

This is where Norsk Titanium is bridging the gap between quality and new, more efficient technology. Its patented RPD® technology allows the company to consistently produce titanium parts of forging quality, while significantly reducing production time, energy usage and cost.

Qualification process

Norsk Titanium has managed to create certain barriers to entry within high consistency and critical markets, such as aerospace and defence. The RPD® process is protected by over 190 patents, while Norsk Titanium is also the only AM company with qualifications and material specifications with Boeing and Airbus. These qualifications have received approval from the FAA and the EU Aviation Safety Agency (EASA). Necessary approvals are a long and difficult process due to the high financial and reputational risk of accidents or incidents, which creates exhaustive qualifications processes from the OEMs.

In addition, the US Department of Defense's (DoD) qualification process requires adherence to Metallic Materials Properties Development and Standardisation (MMPDS). Companies also need to make significant investments to perform a Design of Experiments (DOE), complete process documentation and testing and release AMS specifications. Importantly, Norsk Titanium has no

control over the pace of the qualification process, as the speed at which companies receive qualification for critical structural parts depends on official agencies.

We think it is interesting that a market that has historically been extremely slow in its R&D processes is now being challenged by Norsk Titanium's 21st century technology.

We started here...

Source: Carnegie Research, Norsk titanium

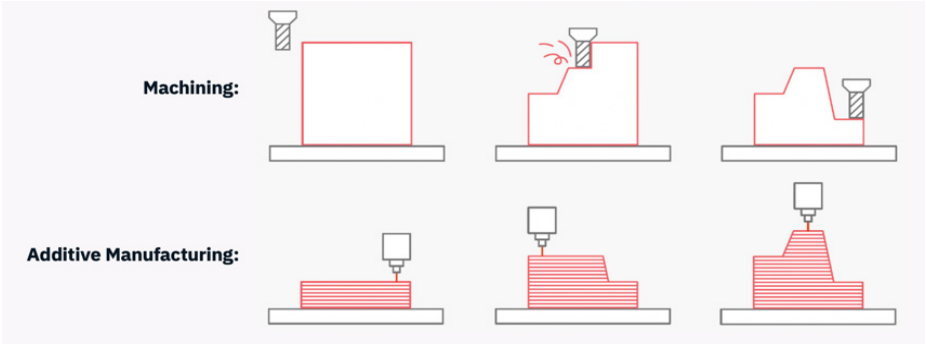
...and ended up here - for now

Source: Carnegie Research, Norsk Titanium

Differences in production method

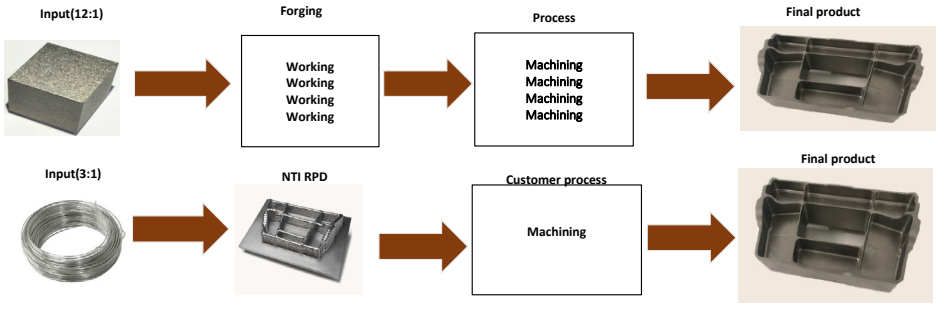
The conventional forging process, from raw material to final component, is very long. The products have to be refined and 'worked' on repeatedly over numerous phases of the production cycle to achieve forging quality. With Norsk Titanium's RPD® technology, it is possible to create a near-net-shape and thus a final component much quicker, while significantly reducing the amount of material needed from input to final product.

A very different approach to production



Source: Carnegie Research

NTI vs. incumbent method of production



Source: Carnegie Research, Norsk Titanium

Material waste

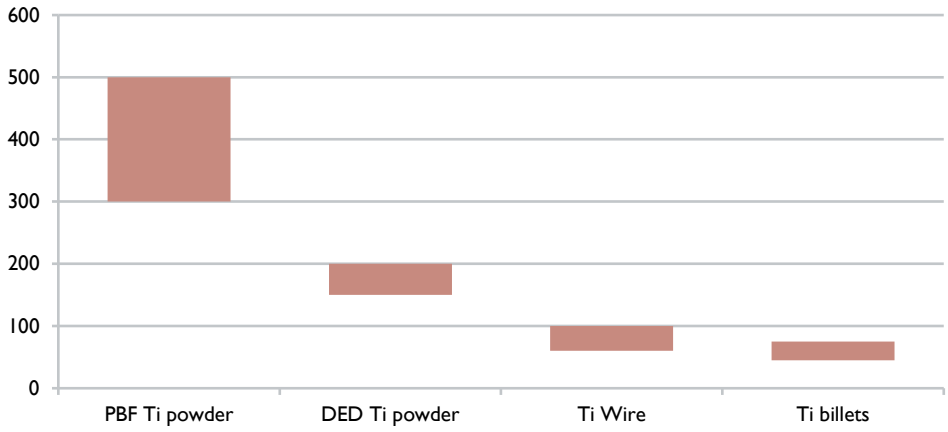
In simplest terms, Norsk Titanium's technological advantage over incumbent producers drives its business model. Given the efficiency of the RPD® process, Norsk Titanium can significantly reduce material waste in the input-to-final-product process. By reducing machining, RPD® can reduce the buy-to-fly ratio (the ratio of the mass of initial metal billet to the mass of final product) from 12:1 for conventional titanium forging (and even 25:1 in some cases) to 3:1 for the RPD® process. Titanium metal is generally expensive, so a raw material savings of 75% is significant relative to the end-user price. The lower metal content also reduces capital tied up in inventories of raw materials and semifinished goods, taking down capital costs that will ultimately be charged to the final product.

Recent geopolitical tension and the fact that a majority of global titanium sponge production come from Russia and China is reason to re-evaluate our attitude towards material supply in our view. With limited supply from stable regions such as Japan potentially driving up prices from these regions relative to Russian or Chinese material, the need for reliable raw material supply is clear. Lead times in changing production processes in the aerospace and defence industries are in general long, and the risk of having too high expectations on a disruptive technology such as RPD® is material. However, the structural need for an efficient raw material process is more relevant today versus a more stable geopolitical environment, and should support demand for the RPD® technology for many years to come.

Feedstock cost

Another major advantage of Norsk Titanium's production technique is the choice of feedstock material used in the process. Costs for feedstock titanium metal vary considerably, depending on the production method. Traditional forging incumbents buy titanium billets for USD45−75/kg, while raw material costs for powder-based AM players vary from USD150−500+/kg. Norsk Titanium's feedstock price for titanium wire is USD60−100/kg. Norsk Titanium has been able to keep purchasing costs contained over the last years of rising titanium metal prices. Purchasing volumes have been growing, which has led to a lower purchase price per kilo, according to the company.

Approximate titanium raw material cost USD/kg



Source: Carnegie Research

Machining

In conventional forging, the machining process cost is often significantly higher than the price of raw material input. In comparison, the cost of Norsk Titanium's machining process, which is done by its customers, is approximately equal to the cost of the raw input. After the RPD® process is finished and the near-shape-product is sold, the end-consumer finalises the product by shaving off excess material and processing it further.

As titanium is a hard metal, machining is a slow process, particularly since the material cannot be heated.

Homogenous quality

The process also ensures good metallurgy in that material properties such as tensile (stress), fatigue and elongation reach the level of standard forged titanium. This is extremely important as Norsk Titanium aims to supply critical structural parts to the aerospace industry. In addition, conventional production techniques have very high upfront capital investment requirements in order to produce high-grade titanium. For example, a forging press typically costs USD90m–270m. Norsk Titanium bypasses these large upfront capital requirements as investments are limited to the MERKE IV. As previously described, 32 of Norsk Titanium's 35 machines (as well as two production facilities) were financed by NY State. Norsk Titanium leases each of these machines for USD1 per year.

Lead times can be significantly reduced by using the AM process, when compared to conventional forging. This is possible because AM production is largely based on CAD drawings, and production can therefore begin right away, limited only by raw material input. This should support dramatically reduced inventories, which will tie up less capital.

Energy use

By reducing machine work, the company can realise substantial energy savings, a cost that is significant for conventional titanium production. The company estimates that the RPD® process generates up to 30% less CO2 emissions relative to the traditional forging and machining process, an important step for a commercial aircraft industry looking to reduce its climate footprint, a major challenge for the industry.

RPD technology realize significant cost savings and environmental gains

Improved efficiency and shorter lead time	**5-20x**	**Faster than incumbent processes**
	Up to 75%	**Less machine costs**
Sustainable manufacturing – reduced environmental footprint	**25-75%**	**Less material use vs. incumbent processes**
	50-75%	**Reduction in required machining**
	30%	**C02 savings from the RPD process**

Source: Norsk Titanium

Each of these improvements in the production cycle is positive for the company. When combined, they fundamentally improve the production and the environmental footprint of critical structural parts for the industry.

A titanium component before and after, post-RPD machining

Source: Norsk Titanium

The 3D printing market

The additive manufacturing market began in the 1980s and has since made large-scale improvements in technology, applicability and production capacity. Today, there are a range of different AM technologies available supporting distinct product applications. In general, the technologies differ in five dimensions: heating source used to melt the material; feedstock input; fineness in the final geometry of components; deposition rate; and product quality.

3D printing

3D printing technology has a long history of development spanning more than 40 years. The first patent for 3D printing, which used UV light to harden materials, was filed by Hideo Kodama in 1980. Since then, the 3D technology industry has made major improvements, and the market is growing quickly. In 2019, there was over 170 3D printer manufacturers worldwide.

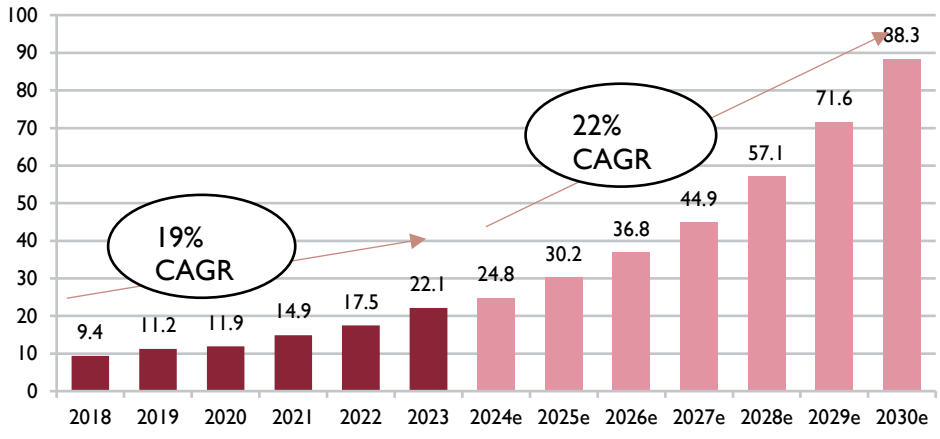
A short timeline of 3D printing technology

1984	Charles Hull invents first form of 3D printing - Stereolithography
1986	Hull patents his technology
1992	First SLA 3D printer is made by 3D systems
1999	First 3D printed organs
2006	First machine that can print in multiple materials is produced
2006	Selective Laser Sintering machine is built
2008	First usable prosthetic leg
2009	3D printed blood vessels
2015	Cellink introduces first standardized commercial bio-ink to the market
2019	Over 170 3D printer system manufacturers worldwide

Source: Carnegie Research, ASME, Preceden

The overall additive manufacturing market is large and set to grow quickly over the coming years. As of 2023, the market was valued at USD22.1bn, and Protolabs estimates it will grow to USD88bn by 2030, with a CAGR of 22%.

AM Market, actuals and estimates, USD bn



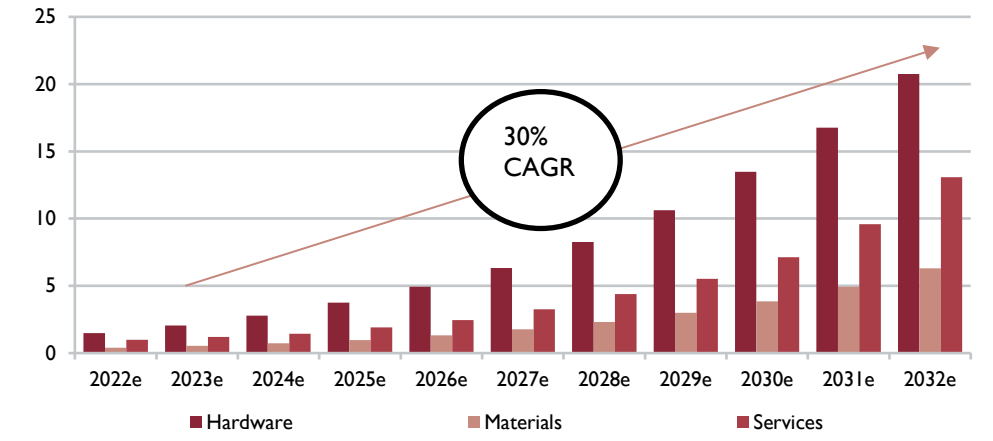
Source: Protolabs, Carnegie Research

Metal additive manufacturing

Dr Carl Deckard developed the first laser sintering 3D printer of plastics in the 1980s. This invention paved the way for metal 3D printing. The first patent for metal AM was filed in 1995 by the Fraunhofer Institute, and in the same year, Binder Jetting technology was licensed to ExOne. Market growth then slowed significantly until 2012, when patents ran out and significant investments were made by GE, HP and DM. Since then, metal AM processes and products have seen widespread commercialisation.

The metal AM market today – largely a subsegment of the broader 3D market – is still experiencing high growth. The market encompasses 3D-produced metal items. VoxelMatters estimates that the metal AM market will grow by CAGR 30% 2023-2032 and to be worth around USD 24,5bn by 2030, including all items in the chart below.

Forecast of metal AM mareket revenues



Source: VoxelMatters, Carnegie Research

There have been major developments in the process and technology used to produce 3D printed components, with several competing technologies and methods. In the next section, we will examine the differences between Wire Directed Energy Deposition (DED) (the technology used by Norsk Titanium) and Powder DED.

Metal AM types

Broadly speaking, within metal AM, depending on the feedstock used (powder or wire), there are two production methods: Powder Bed Fusion (PBF) and Directed Energy Deposition (DED).

Powder bed fusion

Powder-based (SLS and SLM) AM technologies use a laser as the power source to sinter powdered material, aiming the laser automatically at points in space defined by a 3D model, thereby binding powder together to create a solid structure. This process is similar to selective laser melting: the two are similar conceptually but differ in technical details.

Binder jetting technology is similar to the SLS process in that it prints in a powder bed surface. In contrast, the process deposits binder droplets, which bind the powder particles together to form each layer of the eventual component. The process is unique as it does not employ heat to fuse the material together.

A key advantage of these processes over wire-based production is that they can create complex shapes with a very high geometrical accuracy of +/- 0.05mm. Powder feedstock also enables significantly higher resolution in final products.

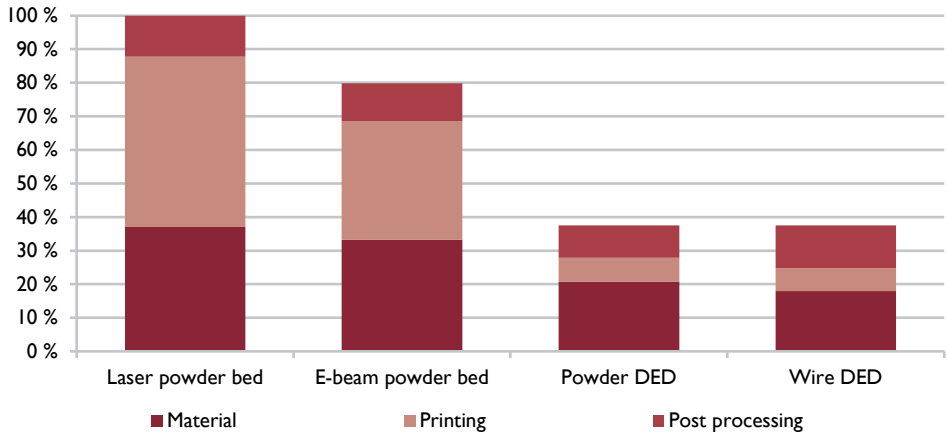
Process	Acronyms	Feedstock	Metals	Ceramics	Composites	Multimaterial
Selective Laser Sintering	SLS, HSS, MJF	Powder		X	X	
Selective Laser Melting	SLM, DMLS, EBM	Powder		X	X	
Directed Energy Deposition	DED, LENS, EBAM	Wire / powder	X			X

X: direct method; near-net-shape

Source: Carnegie Research, MIT

However, a major downside to powder-based feedstock relative to wire feedstock is the high production cost. Titanium wire, which is Norsk Titanium's production feedstock, typically costs ~USD60−100/kg, while powder-based AM companies buy titanium powder for USD250−500+/kg, depending on particle size. Additionally, when using powder feedstock, excess material not used in the final product cannot be reused, increasing waste in the production process.

AM relative titanium manufacturing costs



Source: Digital Alloys, Carnegie Research

Another problem with powder-based products is that final components can have lower-than-average density, which increases porosity. These imperfections in the final part can add stress to the metal, leading to cracks.

The pores can be closed by a process called Hot Isostatic Pressing (HIP). The process, which uses heat and isostatic pressure (equal pressure in four directions), can limit the pores and improve fatigue strength. While this improves quality, the result is never as good as a forged product. Furthermore, the cost is prohibitive for large-scale industrial component production.

USD/kg finished part - material cost	Material	Printing	Post processing
Laser powder bed	519	711	171
E-beam powder bed	466	494	158
Powder DED	291	99	135
Wire DED	251	96	179

Source: Carnegie Research, Digital Alloys

In sum, the cost of the entire production process falls dramatically as one moves from powder to wire inputs. This significantly improves unit economics for Norsk Titanium compared to producers using powder. In addition, powder-based producers cannot demonstrate 100% forging quality in their products, preventing them from supplying structural safety components to the aerospace and defence industry. Therefore, we believe that the general '3D market' is not a part of Norsk Titanium's competitive sphere. Rather, we believe that Norsk Titanium will compete with conventional forging companies such as Howmet Aerospace, ATI, VSMPO-AVISMA, Otto Fuchs and Aubert & Duval (the first two are listed).

Powder DED

Powder DED systems like Laser Metal Deposition (LMD) and Laser Engineered Net Shaping (LENS) feed powder through a nozzle. From there, the powder is melted by a laser beam on the surface of the component. The process is very precise and the resultant thickness for components can be 0.1 mm or less. Due to the problems with porosity, we do not see powder DED as a relevant competitor for Norsk Titanium as yet.

Wire DED

DED forms 3D objects by melting material as it is being deposited, using focused thermal energy such as a laser, electron beam or plasma arc. The energy source and the material feed nozzle are both manipulated using a gantry system or robotic arm. The feedstock wire is melted and deposited onto a specified surface, building the component up layer by layer.

Wire DED technologies are mainly differentiated by the energy source used to melt the feedstock. The three main subtypes are laser-based, electron beam and plasma DED.

The main advantages of using wire DED over powder DED relates to production speed (except for Binder Jetting), cost savings, quality of final component and safety advantages.

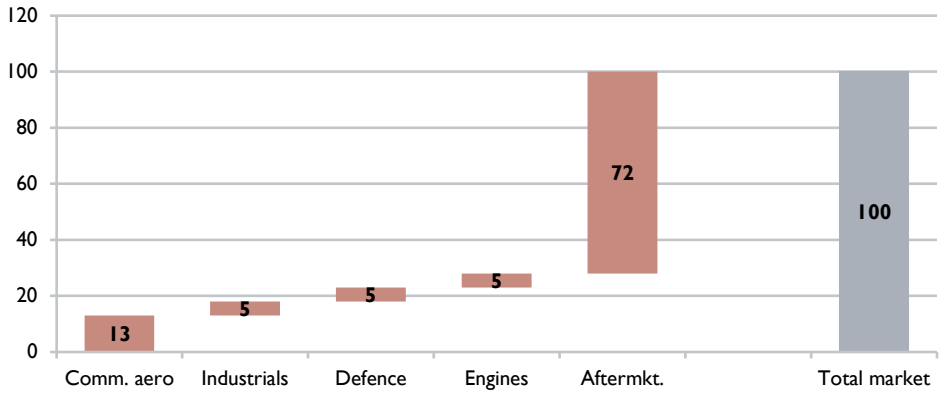
In terms of the broader AM market, we expect that Wire/ Plasma deposition technology is maturing into industrial use.

Our view is that other wire-based AM are lacking in most areas relative to Norsk Titanium's RPD®. Norsk Titanium's parts are made in a chamber, in an inert argon atmosphere with separate in/out loading, which makes production very rapid. Potential competitors' components are produced in a vacuum, which makes the process relatively slow, since products must be produced in batches. Furthermore, potential wire-based producers also lack Norsk Titanium's vast database of production data and documentation, and its extensive experience in qualification processes.

Norsk Titanium in a prime position to grow with the metal AM market

The metal AM market has started to gain traction with large industrial companies in the aerospace and defence industry and for general industrial use. The company currently estimates a total addressable market (TAM) of USD 100bn, of which USD 13bn and USD 5bn stem from the aerospace and defence markets, respectively. The industrials market, such as the semiconductor industry, accounts for another USD 5bn in market potential. This is based on end-use prices. Norsk Titanium produces near-net-shape parts, so its relevant share of TAM is roughly 50% the company estimates.

Titanium parts - TAM for NTI's RPD technology - USDbn



Source: Norsk Titanium, Carnegie Research

Even at a conservative 1% market share, Norsk Titanium is looking at a significant potential market. In our view, there is no shortage of growth opportunities for the company, and if Norsk Titanium continues to hold its competitive position, along with large-scale industry adoption of AM technology, we believe it has the potential to become a profitable player if the company can ramp-up production in line with our estimates. At full production capacity, Norsk Titanium can produce 700Mt of components per year. While we do not expect the company to operate at full capacity in the near term, the fact that it has infrastructure to produce at significant scale in the future is positive due to the benefits of substantial operational leverage.

Given that Norsk Titanium produces near-net-parts, we believe the actual TAM that it can address is approximately USD75bn. Assuming a 1% adoption rate from this figure implies a current market size of USD0.75bn for Norsk Titanium.

Actual NTI TAM (USDbn)

Adoption rate (%)	20	30	40	50	60	70	80
0.4 %	0.08	0.12	0.16	0.20	0.24	0.28	0.32
0.6 %	0.12	0.18	0.24	0.30	0.36	0.42	0.48
0.8 %	0.16	0.24	0.32	0.40	0.48	0.56	0.64
1.0 %	0.20	0.30	0.40	**0.50**	0.60	0.70	0.80
1.2 %	0.24	0.36	0.48	0.60	0.72	0.84	0.96
1.4 %	0.28	0.42	0.56	0.70	0.84	0.98	1.12
1.6 %	0.32	0.48	0.64	0.80	0.96	1.12	1.28

Source: Carnegie Research, Norsk Titanium

Titanium and its properties

Titanium and its properties

Titanium is a silvery grey chemical element discovered in 1791. Since then, its applications within aerospace, chemicals, automotive and the health market have been growing exponentially due to the metal's inherent metallurgic qualities.

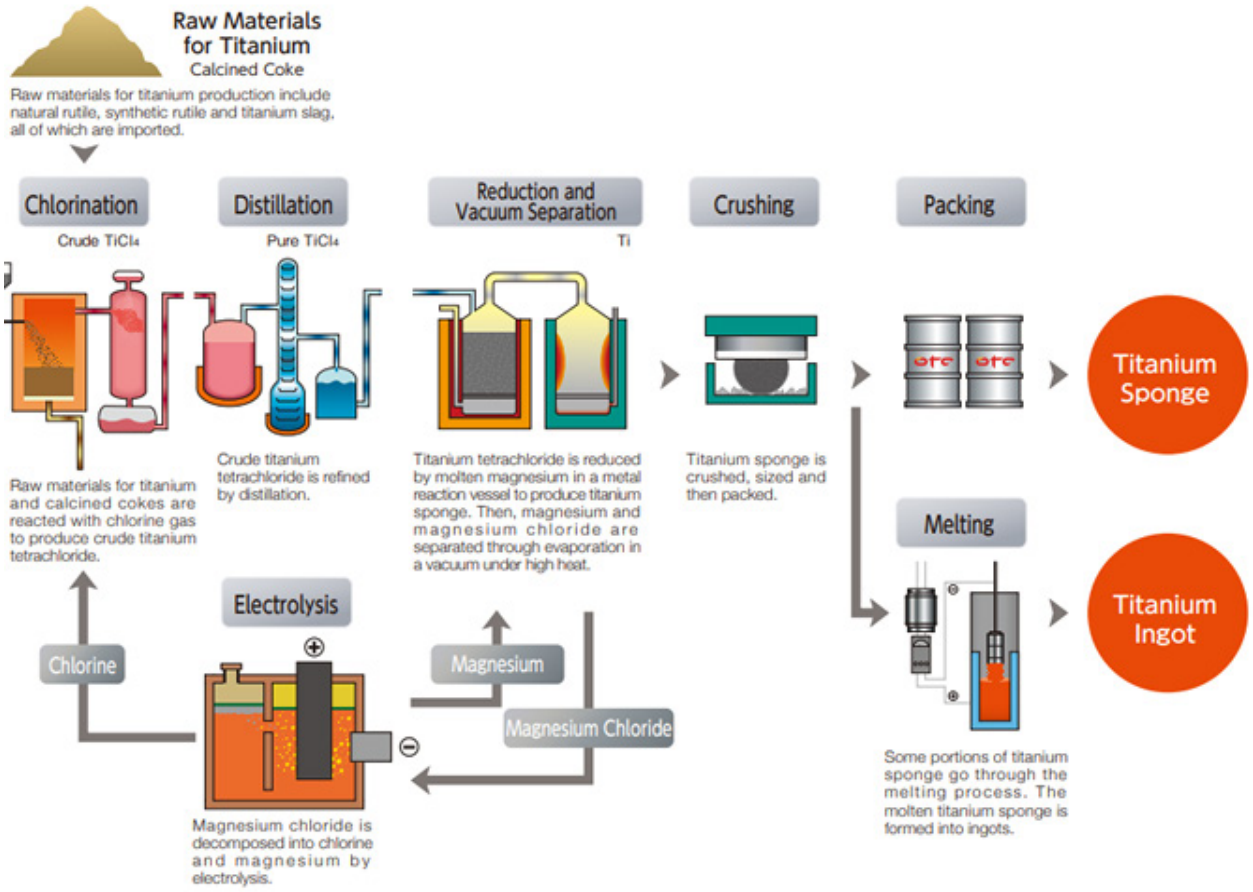
Titanium is the fourth most abundant structural metal on Earth, exceeded only by aluminium, iron and magnesium. The largest workable mineral deposits are found in Australia, the US, Sierra Leone, Russia and Norway. While an abundant metal in the Earth's crust, most titanium is used to produce titanium-dioxide, a white powder material used as a pigment in paint, sunscreen and food colouring. TIO2 accounts for around 95% of total titanium consumption.

Titanium metal (5% of total titanium production), on the other hand, requires costly production methods. It is highly reactive to oxygen, nitrogen and hydrogen, requiring costly production steps to extract. In addition, due to its high melting point, large amounts of energy are needed to transform the metal. There are also significant price differences between titanium metal and titanium dioxide: titanium metal is typically 50x–100x more expensive than TIO2.

Titanium offers important qualities and applications for many industries, including aerospace, defence, healthcare and chemicals. It has the highest strength-to-density ratio of any metallic element for temperatures up to 500°C. This makes it ideal for aircraft production, where weight is an important factor affecting fuel burn. Titanium has a very high thermal capacity, which makes it an excellent metal for use in machines and engines. Finally, titanium has very high corrosion resistance: when exposed to the atmosphere, titanium forms a tight, tenacious oxide film that resists many corrosive materials.

Producing a titanium ingot is complex. Raw material is processed through a chlorination process to produce crude titanium tetrachloride, which is then refined by distillation. The material then goes through reduction and vacuum separation, resulting in a titanium sponge. The conversion of purified titanium sponge to a form useful for industrial purposes takes a long time. First, the sponges (and sometimes alloying elements) are welded into a cylindrical electrode. This electrode is melted in a water crucible by passing electric current through it. If alloyed, the ingot is remelted at least once in a similar manner to ensure uniform distribution of alloying elements in the final ingot.

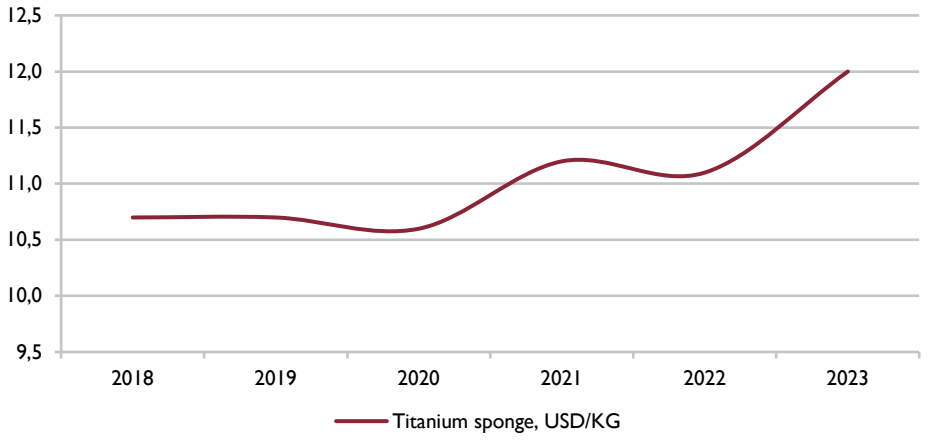
Raw titanium metal extraction and production



Source: Carnegie Research, Oska Titanium Tech

The price of titanium metal is rising and supply is a challenge, while the price of titanium sponge has risen double-digit since 2020, in the US. We believe geopolitical turbulence – in 2023 some 260,000mt of titanium metal was produced in China and 46,500Mt in Russia, out of a global total of 410,000mt – is forcing many buyers to source from other countries, which is driving up prices in the US.

Price of titanium sponge metal in the US



Source: Statista, Carnegie Research

Market backdrop by customer groups

There is a clear trend globally for increased adoption of new and innovative technological solutions to old problems. At the same time, end-products in most industries are becoming more complex and sophisticated. In the metals industry, additive manufacturing is trying to bridge this gap by providing tailored metal production, and industries are catching on. Given the recent news flow from Norsk Titanium regarding serial production to the aerospace industry, this is the strongest value driver for the company over the next few years, in our view. In short, the prospects look bright for both Boeing and Airbus, Norsk Titanium's most well known customers currently.

The commercial aerospace market

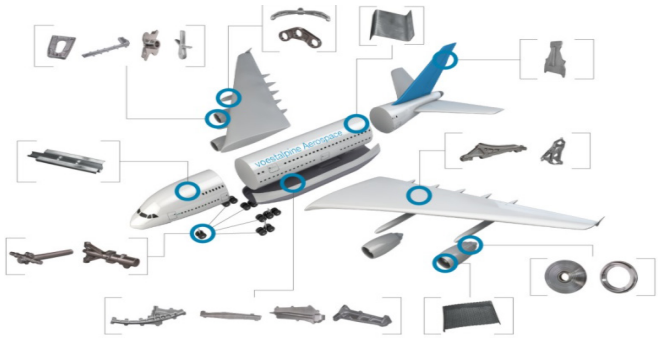
Norsk Titanium's most important market is currently the aerospace market, where customers include Boeing, Airbus and Spirit.

The aerospace industry needs to optimise weight, density and other factors when constructing airframes in order to reduce fuel expenditure. Aluminium has historically been the primary metal for plane construction, but the industry has over time been switching to other materials. Use of composite materials in aircraft is growing quickly, which also is a driver for titanium. Titanium does not corrode when exposed to composite materials, while other metals such as aluminium may. While titanium is 60% heavier than aluminium it is also twice as strong, meaning that less metal is needed. In addition, it is 50% lighter than steel and 30% stronger. Titanium is good for thermal applications due its high melting point. It offers excellent tensile strength and scores very high when fatigue is a critical benchmark.

An example of this change can be seen in Boeing's production, where from the Boeing 777 to the 787, the use of titanium increased by around 100% (by airplane weight). According to company estimates, components to be produced within this market include brackets, nacelles, pylons, landing gear and business jet applications. There are approximately 2.3m parts in a 787, and titanium parts account for 15% of them by weight. There are approximately 1000+ different titanium parts in a 787, of which 95% are structural grade components.

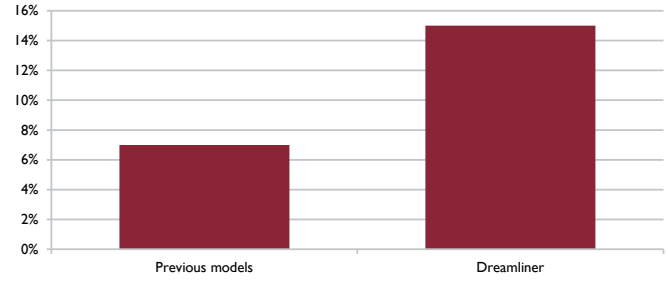
While titanium accounts for 15% of a Dreamliner's weight, the average titanium content for the current global commercial airliner fleet is around 7%. This suggests that new models of aircraft will likely contain increasing amounts of titanium going forward.

Titanium parts are used everywhere



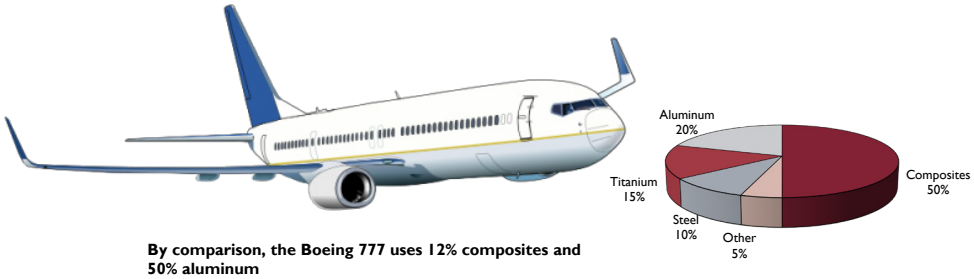
Source: Boeing, Carnegie Research

Titanium content in aircrafts



Source: Boeing, Carnegie Research

Typical material composition in a Boeing 787 body

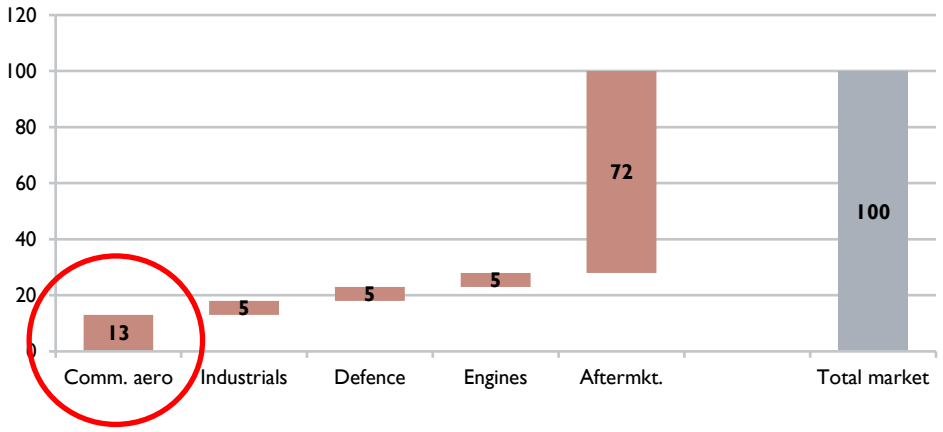


By comparison, the Boeing 777 uses 12% composites and 50% aluminum

Source: Boeing, Carnegie Research

Norsk Titanium estimates the AM commercial aerospace market is currently worth USD13bn.

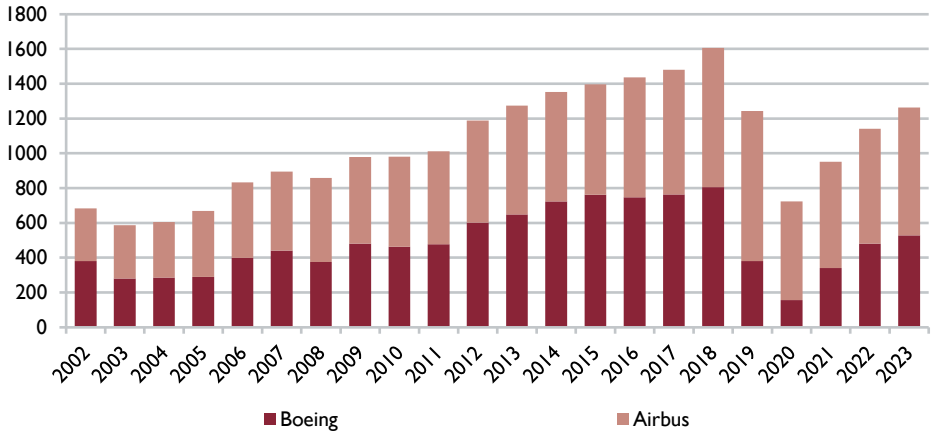
Titanium parts - TAM for NTI's RPD technology - USDbn



Source: Norsk Titanium, Carnegie Research

After a few challenging years impacted by the pandemic and supply chain problems, demand for commercial aerospace is taking off. Deliveries have been strong since the trough year 2020, although they only recovered to 2012 levels in 2023.

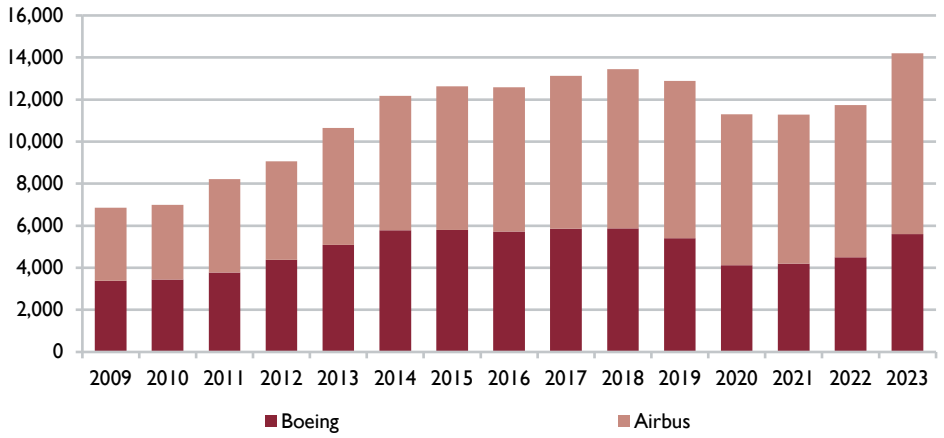
Deliveries # commercial aircrafts



Source: Company data, Carnegie Research

From a demand perspective it is therefore encouraging to see that the backlog of commercial aircrafts is finally taking off. We believe the recent contracts signed with both Boeing and Airbus are a clear signal that both companies are seriously looking into ramping up production rates and therefore want to secure parts, many of which Norsk Titanium could produce.

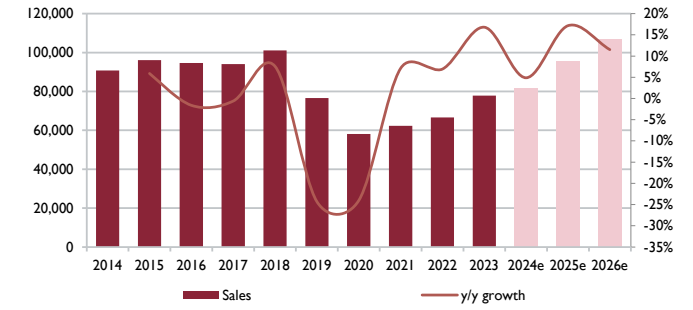
Backlog # commercial aircrafts



Source: Company Data., Carnegie Research

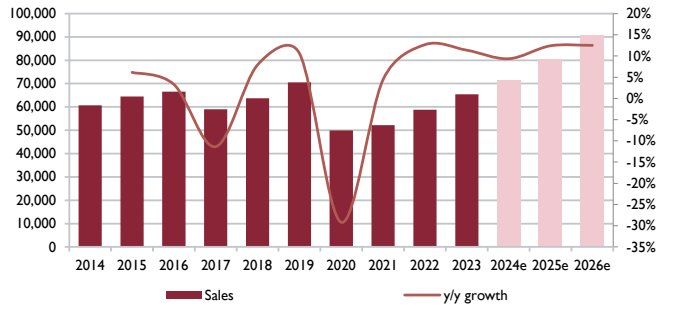
We expect the market backdrop for aerospace to be healthy over the next few years. In the commercial aerospace end-market, FactSet consensus expects both Boeing and Airbus to show topline growth in 2024–26. This marks an important shift in demand from this industry after several years of weak topline growth in the wake of the pandemic and company-specific problems for Boeing, e.g. the 737 Max.

Boeing sales, actual and estimates



Source: FactSet, Carnegie Research

Airbus sales, actuals and forecasts



Source: FactSet, Carnegie Research

Defence industry

The defence industry is another market for additive manufacturing of titanium. The defence industry is similar to aerospace in that the strength-to-weight ratio of materials must be high. Norsk Titanium is actively working on contracts and is engaged with multiple partners to develop material for this market.

Several military aircraft in the industry utilise large amounts of titanium for manufacturing. These include the F-22, F/A-18 and the C-17. The UH-60 Black Hawk helicopter uses titanium and fiberglass in its main rotor blades. For its F-35 fighter, Lockheed Martin has already started sourcing some titanium components from AM manufactures.

The main use-cases in the defence market for metal additives range from military aircraft to auxiliary power units, ducts, heat shields, engine cases and missile systems. Norsk Titanium estimates the defence market size at around USD5bn.

More recently, Norsk Titanium, have received qualifications and production orders with US Department of Defence prime contractors in and received a complete material qualification with Northrop Grumman.

Industrials

The industrials market has accelerated as a growth driver over the last few years. For now, it is mainly the semiconductor industry, and more specifically carrier trays, that Norsk Titanium highlights in its external communication as its parts in serial production. However, given titanium's strong metallurgical features such as low weight, and corrosion and heat resistance, we see many potential applications for AM players such as Norsk Titanium in the industrials segment. Norsk Titanium's estimate of the market size is USD5bn, in line with its assessment of the defence market.

Aftermarket and adjacent markets

We believe maintenance, repair and overhaul (MRO) in the aerospace, engine and defence industries could potentially grow into an important market for the group. While OEMs have already begun using AM products, AM manufacturers could address the MRO industry due to the inherent flexibility of the AM production process. In addition to spare parts being printed on demand, they could also be repaired by additive production methods. Both uses offer an attractive business case for the group, in our view.

Norsk Titanium is also examining the possibility of supplying adjacent markets, including energy, electronics, automotive, marine, and satellite & launch. With market acceptance by these industries, Norsk Titanium should be able to meet their demand for components, given RPD®'s ability to make products from metals other than titanium.

Competitive landscape

Incumbent producers: fight or flight?

Incumbent market participants include Howmet Aerospace, ATI, VSMPO-AVISMA, Aubert & Duval, Allegheny Technologies Inc., and Otto Fuchs, to name the largest players. These firms can be characterised as traditional forging companies, and will be Norsk Titanium's biggest future competitors, in our view. It remains to be seen if the incumbents will focus on developing their own AM technology and thus become clear competitors to Norsk Titanium. These firms are large and have substantial capital, which may constitute a risk going forward, but they are also potential acquirers of Norsk Titanium.

While the competitive landscape is still a problem for Norsk Titanium, we believe less so today than a few years back. The two listed competitors ATI and Howmet are currently enjoying a buoyant market backdrop with solid growth, expanding margins and strong cash flows. We believe the strong structural demand trends for both commercial aerospace and defence spending, on the back of catch-up post-pandemic and geopolitical tension respectively, offer room to gain a foothold in this market.

A few quotes from both companies Q1 releases (our formatting in bold):

Howmet

- "Revenue of $1.82 billion, up 14% year over year, driven by **commercial aerospace, up 23%"**
- "Net income of **$243** million **versus $148** million in the first quarter 2023"
- "Operating income margin of **20.2%"**
- "Generated **$177 million of cash from operations**"
- **"Share repurchases of $150 million**; $0.05 per share dividend on common stock"

ATI

- **"31% YoY growth** in titanium ("Ti") shipments driven by aero and aero-like growth"
- "Shipments of **airframe materials up 12%** versus prior year, despite HPMC outage impacts"
- **"Strong YoY increase** in defence materials driven primarily by higher shipments of military jet engine and rotorcraft forgings"
- "Continued growth expected throughout 2024 led by naval, ground vehicle demand"
- "Continued demand strength and **increased shipments of titanium** airframe materials"

VSMPO-AVISMA is the world's biggest producer of titanium metal and it has ongoing business relationships with Boeing and Airbus. Aubert & Duval has a powder AM production facility, and Howmet Aerospace produces titanium extrusions and other products for aircraft.

We present some information about the financials of the listed companies, to give picture of their size, as exemplified by the tables below.

ATI - USDm	2019	2020	2021	2022	2023
Revenues	4123	2982	2800	3836	4174
EBITDA	439	196	251	537	633
EBIITDA-margin	11%	7%	9%	14%	15%

Howmet - USDm	2019	2020	2021	2022	2023
Revenues	7105	5257	4972	5663	6640
EBITDA	1659	1152	1136	1299	1517
EBIITDA-margin	23%	22%	23%	23%	23%

Source: Company data, Carnegie Research

Today we see limited or no competition from other AM companies

Norsk Titanium has competitive advantages over other wire-AM manufacturers. Norsk Titanium is the only AM company with qualifications and material specifications with Boeing and Airbus thanks to the forging-level quality of its components. A key factor that enables this quality is the patent-protected quality assurance program the RPD® process runs while components are being produced.

EBAM, (Electron Beam, i.e. another energy source) an alternative wire-AM technology to the RPD® process, is lacking in most areas relative to RPD®, as shown in the graph below. The components must be produced in batches in a vacuum atmosphere. This reduces the efficiency of the production process. In addition, the EBAM process needs to run a test component before every batch.

Powder-based producers have a major downside in that their feedstock is very expensive. Another problem with powder-based products is that the final components can have lower-than-average density, which increases porosity. These imperfections in the final part can add stress to the metal, leading to cracks, making them unsuitable for the aerospace and defence industries.

	Quality	Cost	Speed	Fineness in geometry
Powder	X	X	X	X
Wire				
EBAM	X	X	X	X
RPD	X	X	X	X

Source: Carnegie Research, Norsk Titanium

Competition from other modern production players likely to rise over time

Over time, we believe that Boeing and Airbus, together with other OEMs in the A&D industry, will try to broaden the supplier landscape, and we foresee competition arising from other producers and production methods. AM and other modern production technologies are probably at the starting point of the Product Life Cycle and are likely to incur many new entrants. Having said this, we believe Norsk Titanium's current position offers a first mover advantage that the company can capitalise on to reach a profitable and thus self-sustained business model.

Estimates and financials

We foresee strong growth on the back of Norsk Titanium's recently signed agreements, the structural drivers for increased use of titanium parts in aerospace and defence, and cyclical support from the commercial aerospace industry. In 2026 we expect revenues of USD151m and EBITDA of USD44m, with growth prospects thereafter.

We factor in that Norsk Titanium should start receiving material serial orders from 2024, which then speed up rapidly as RPD® becomes ever more recognised. This is supported by company guidance, which has set out targets for the number of parts in serial production, and the corresponding ARR connected to these parts, during the ramp-up phase to 2026e. Norsk Titanium targets revenue of USD150m in 2026. This is 10x higher than the 2024e guidance of USD15m and 60x higher than 2023 revenue. The adoption of material-efficient technologies has brighter prospects than when the target was set in 2021 due to increased geopolitical tensions since then. Moreover, management is reiterating its financial guidance, despite the short time frame from now to 2026. We therefore factor in the 2026 guidance in our estimates, backed by our estimated quarterly ramp-up schedule. From here, we believe revenue can grow at 35% per year until 2029, with a decreasing growth rate thereafter to reach 7% in 2040.

On our long-term estimates, we believe Norsk Titanium can achieve an EBITDA margin of around 25%, much higher than the 2024–26e average of aircraft parts manufacturers, 16.5%, but in line with traditional incumbent Howmet's 24% for the same period (all according to FactSet). We believe the current market backdrop offers a clear sweet spot due to the combination of a rising backlog from the commercial aircraft majors Boeing and Airbus, and the current geopolitical challenges to source titanium metal. On top of this, we see strong incentives from both defence and semiconductor producers to increase AM parts from Norsk Titanium. In this environment, a 30% EBITDA margin in 2026 is achievable, in our view, as we see interest from the aircraft OEMs, in particular, in broadening the competitive landscape. This margin scenario requires the company's management to keep the current streamlined organisation in order to harvest all the benefits of the current competitive position.

These forecasts form the basis for the high end of our fair value range. However, the anticipated growth in company targets is a challenge, and being prudent, we have worked with an alternative scenario, where growth is ramping up slower than in company guidance, implying lower margins and CAGR sales growth, the basis for our valuation framework. In this scenario we see 2026e as a break-even year for NTI. This alternative setting forms the basis for the low end of our fair value range.

Today NTI's cash burn rate is around USD20m per year, and we expect the cost base to start to increase, albeit much more slowly than revenues as there is ample production capacity to handle increasing revenues. We also expect the current warrant to be fully exercised, which should take the business to self-financing in 2026e. Norsk Titanium is currently capital-light and its capex needs seem limited over the next 7–8 years, as our estimates imply an operating rate slightly above 50% after 2026e.

Revenue expected to take off on the back of recent signed agreements

Over the past few years, Norsk Titanium has been focused on securing testing and qualifications. Revenues have been in the low single-digit USDm, with limited product sales relative to other revenues. However, the recent announcements from the commercial aerospace customer segment should mark the starting period for real and substantial revenues to start to flow into the P&L. The company has guided for the following chain of events:

Current company guidance

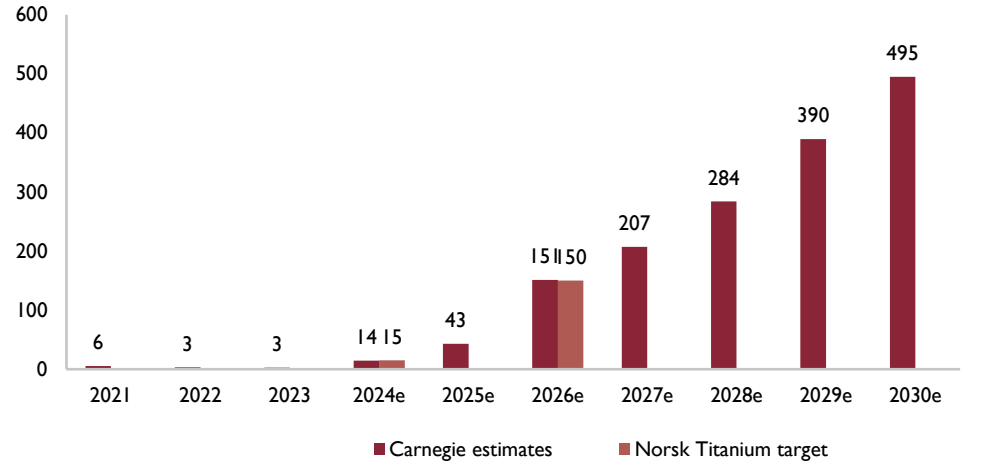
	YE 2022	H1'23	YE 2023	H1'24e	YE 2024e	Description
Parts in serial production	7	8	11	~30	>60	Parts in serial production for tier-1 suppliers to leading OEMs in target markets
Annual recurring revenue of parts in serial production	$1m	$2.5	$4m	~$10	$50	Estimated total annual revenue opportunity for parts in serial production

Source: Norsk Titanium

The company's 2024 revenue target is USD15m, implying that 2024 is still very much a ramp-up year as annual recurring revenue (ARR) is guided at USD50m, based on number of parts in serial production.

The chart below outlines our estimates and Norsk Titanium's own targets. The company aims for USD150m in revenue in 2026 (based on less than 50% capacity utilisation). We see the 2026e target as challenging, but possible to reach. We stress that Norsk Titanium is a long-term case and that there could be volatility in actual sales as the company matures.

Norsk Titanium revenues - USDm



Source: Norsk Titanium, Carnegie Research

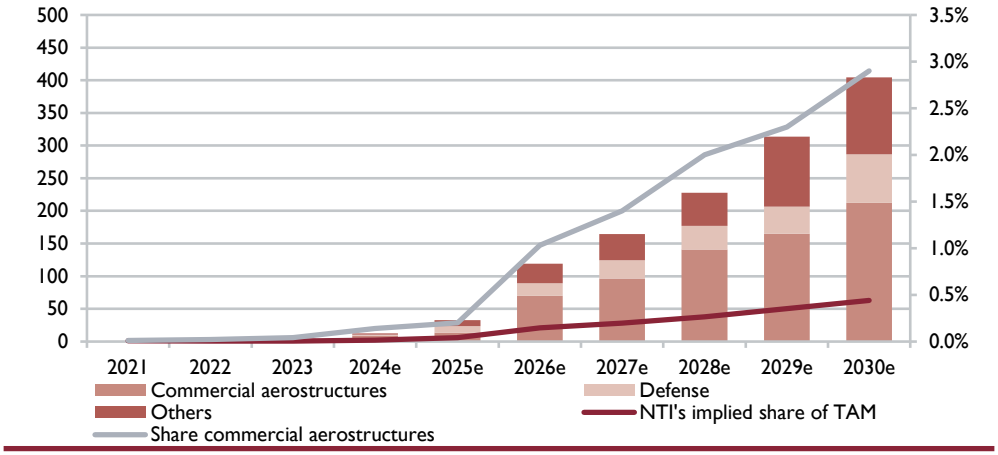
We provide our estimates in the table below:

Norsk Titanium - USDm	2020	2021	2022	2023	2024e	2025e	2026e	2027e	2028e	2029e	2030e
Revenues	**1**	**6**	**3**	**3**	**14**	**43**	**151**	**207**	**284**	**390**	**495**
COGS	396%	73%	112%	203%	90%	60%	50%	53%	53%	53%	53%
Gross margin	-3	2	0	-3	1	17	76	97	135	185	235
EBITDA	**-27**	**-17**	**-19**	**-23**	**-23**	**-11**	**44**	**52**	**71**	**97**	**124**
Depr./impairm.	-3	-3	-2	-2	-2	-2	-2	-4	-4	-5	-6
EBIT	**-30**	**-20**	**-21**	**-25**	**-25**	**-13**	**42**	**48**	**67**	**92**	**118**
Net finance	-13	4	12	-1	0	0	0	0	0	0	0
Pre-tax profit	**-43**	**-16**	**-9**	**-27**	**-25**	**-13**	**42**	**48**	**67**	**92**	**118**
Net profit	**-43**	**-16**	**-9**	**-27**	**-25**	**-13**	**32**	**37**	**52**	**71**	**91**
Capacity (mt)	0	700	700	700	700	700	700	700	800	1,000	1,200
Op rate	0%	2%	2%	1%	4%	10%	39%	53%	63%	68%	70%
Sales (mt)	0	6	11	7	29	69	275	371	501	677	846

Source: Norsk Titanium, Carnegie Research

The growth we expect in 2027–30e is driven by still strong end-market overall demand, driven by evolving customer preferences and growing emphasis on sustainability and supply chain risk in the commercial aerospace industry. In defence, we expect the current geopolitical tensions to remain, while regions such as Europe have underspent on defence spending for many years, implying solid growth prospects as they look to catch up. In the semiconductor industry, we expect ongoing digitalisation to drive demand for semiconductors, and consequently the necessary production equipment. For example, ASML is growing rapidly, +32% in 2025 and +9% in 2026e after a more muted 2024e, according to FactSet. On top of all this comes our expectation of a higher share of titanium parts in the aerospace and defence industries, and finally the AM technology replacing the traditional forged and machined parts. In total, we expect an overall market share for Norsk Titanium below 0.5% of TAM, i.e. insignificant despite strong sales growth.

Norsk Titanium revenues (USDm) and share of TAM



Source: Norsk Titanium, Carnegie Research

Over the next few years, i.e. in the ramping up period to 2026e, we believe the 30% EBITDA margin target is credible. Given the recent strong financial performance of incumbents, e.g. Howmet, we expect the balance of power to skew away from the large aerospace and defence companies and towards the suppliers of titanium parts. We therefore consider it likely that Boeing and Airbus are prepared to support new suppliers such as Norsk Titanium, at least while the

product quality is as high as is currently the case. These big customers have an incentive to support Norsk Titanium's margin over the next few years. Currently, Norsk Titanium has plenty of spare capacity, implying limited need to invest in equipment or in the organisation and thereby offering solid operational leverage to support the rising demand that we expect.

For Norsk Titanium, we factor in COGS of around 50–55%, and 22–23% for other costs. Given the heavy ramp-up activities we expect, we have scaled other costs with the revenue growth from 2026 and onwards. With this as a backdrop, we believe Norsk Titanium can generate an EBITDA margin of 25% in 2027, since its costs are significantly lower (both raw materials and machining costs) than the traditional incumbents'. We note that depreciation is low, even at the end of the estimate period. This is because around USD125m of equipment and the two US production sites were sponsored by the State of New York. In 2027e, the operating rate is slightly above 50%, so Norsk Titanium should only need to increase capacity in 2028, we believe.

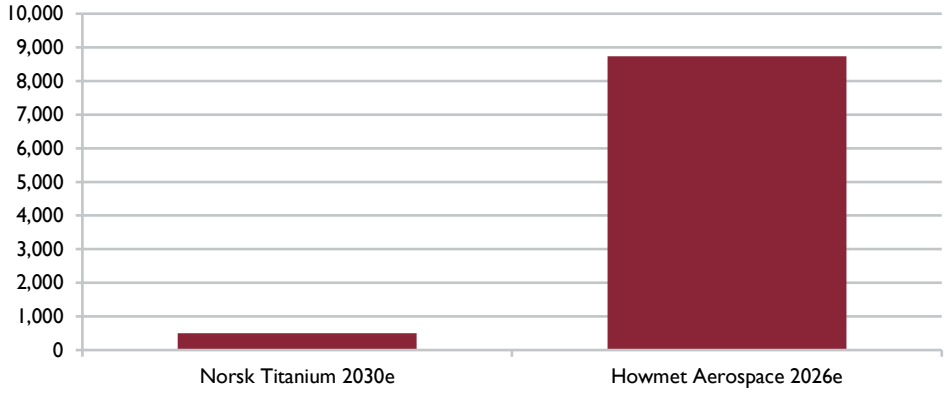
High current burn rate – a prerequisite for the recent agreements with the major OEMs

Norsk Titanium's burn rate has been high for many years, USD23m on average for 2018–23, which is challenging investors' patience. However, we believe Norsk Titanium is about to reap the rewards after many years of investment in products, people and processes to gain confidence in its industrial, operational, testing and qualification knowhow. Lead-times and qualification standards in the aerospace and defence industry are significant, but the recent agreements with Boeing and Airbus are the best indication that the long qualification process is drawing to end.

Small player relative to Howmet even in a strong growth scenario

If we compare our 2030 earnings scenario withe the main incumbent Howmet, Norsk Titanium is still a relatively small player in comparison. Excluding forged wheels, the segment the least comparable to Norsk Titanium which represents 17-18% of Howmet's historical revenue split, the picture is intact. We therefore conclude that that Norsk Titanium can grow at an impressive growth rate without becoming a real threat the Howmet.

Revenues - Norsk Titanium vs Howmet (Aerospace) - USDm



Source: FactSet, Carnegie Research

Low capital needs until 2030e should allow for self-financing from 2027e

We expect the upcoming warrant issue to be fully subscribed. This capital, together with already announced capital injections during 2024, should make the company self-financed by 2026e. The business model is capex-light, at least until 2030e, as the main production facility in Plattsburg is leased from the state of New York for USD1 per year until 2030. However, from 2028e we expect expansion capex to grow as a constantly increasing operating rate will fill up the production asset base. During the 2024–26e ramp-up phase, we expect working capital build-up before normalising at 32% per year for the rest of the forecasting period.

Cash Flow - USDm	2020	2021	2022	2023	2024e	2025e	2026e	2027e	2028e	2029e	2030e
EBITDA	-27	-17	-19	-23	-23	-11	44	52	71	97	124
Change NWC	0	-4	-1	1	-3	-9	-32	-17	-25	-34	-34
Tax	**0**	**0**	**0**	**0**	**0**	**-1**	**-2**	**-3**	**-4**	**-5**	**-27**
Others	-14	0	0	0	0	0	0	0	0	0	0
Cash flow from op.	**-42**	**-21**	**-20**	**-22**	**-26**	**-20**	**9**	**32**	**42**	**58**	**63**
Maintenance capex	-1	0	-1	0	-1	-2	-2	-2	-2	-3	-4
Growth capex	0	0	0	0	0	0	0	0	-10	-20	-20
CAPEX	-1	0	-1	0	-1	-2	-2	-2	-12	-23	-24
Free cash flow	**-43**	**-21**	**-20**	**-22**	**-27**	**-22**	**7**	**30**	**30**	**35**	**39**
Equity issue	0	39	7	8	61	0	0	0	0	0	0
Dividend	0	0	0	0	0	0	0	0	0	0	0
Net change IBD	28	3	0	8	-5	0	0	0	0	0	0
Net Interest	14	0	0	0	0	0	0	0	0	0	0
Net cf from financing activitie	**43**	**43**	**6**	**16**	**56**	**0**	**0**	**0**	**0**	**0**	**0**
Change cash	0	21	-14	-6	29	-22	7	30	30	35	39
FX	0	-1	-1	0	0	0	0	0	0	0	0
Cash beg year	2	2	23	8	1	30	7	14	44	74	109
Cash YE	2	23	8	1	30	7	14	44	74	109	148

Source: Norsk Titanium, Carnegie Research

Light balance sheet based on the business model

We expect the balance sheet to be remain light given the business model, with leased assets at the main production facility in Plattsburgh. One important feature is that Norsk Titanium, which is unusual among companies working with high growth prospects, has not capitalized development costs on its balance sheet. This reduces the risk of future write-downs of intangible assets.

Balance Sheet	2020	2021	2022	2023	2024e	2025e	2026e	2027e	2028e	2029e	2030e
Intangible assets	8	6	4	3	3	3	3	3	3	3	3
Other non-current assets	6	5	6	5	4	4	4	2	11	29	46
Cash/cash equivalents	2	23	8	1	30	7	14	44	74	109	148
Inventories	5	5	5	6	10	13	45	62	85	116	148
Receivables	1	0	1	1	4	12	20	27	38	52	66
Other	1	3	3	1	4	8	12	14	19	26	33
Total assets	23	42	27	17	55	47	98	152	229	334	443
Equity	-81	34	17	-1	35	22	54	91	143	214	305
IB LT debt	89	0	2	0	0	0	0	0	0	0	0
Trade/Payables	2	1	1	2	6	8	16	23	31	42	53
Others	14	5	5	7	14	17	29	38	55	78	85
Total Equity/Liabilities	23	42	27	17	55	47	98	152	229	334	443

Source: Norsk Titanium, Carnegie Research

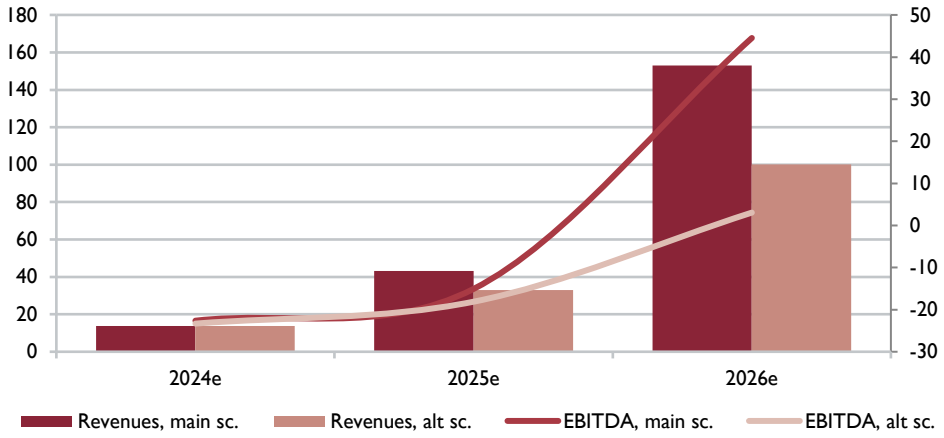
Low FX exposure – USD is the main currency

Excluding operating costs for the Norwegian operations, which will host around half of employees in the next few years, NTI's costs are mainly USD-based. Titanium is priced in USD, and most revenues are based in USD, which makes FX risk low in our view.

Alternative scenario – low end of our fair value range

According to our estimates, Norsk Titanium is at an inflection point for moving into the industrial scale of its operations. However, the growth rate that is implied by the financial guidance, and that we have also factored into our estimates, assumes excellent execution with good support from external factors such as solid demand from the key customer industries and continued focus on reliable supply chains. Given the uncertainty of these factors we have built an alternative scenario, which we see as unlikely but still possible. This scenario is built on, still healthy, but less spectacular growth, and implies breakeven EBITDA in 2026e. This earnings scenario forms the basis for the low end of our fair value range (see Valuation section below).

Revenues and EBITDA in our different scenarios



Source: Carnegie Research

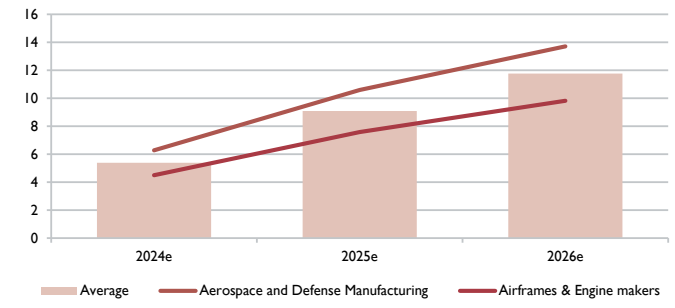
Valuation

We initiate coverage of Norsk Titanium with a fair value range of NOK3.5–5.4. As a basis for our valuation framework, we have used a regression model based on CAGR sales growth for 2024–26e combined with our EBITDA(26e) margin and EV/S. Based on our current estimates the regression model returns the high end of our fair value range. To reach the low end of our fair value range, we have used our alternative ramp-up scenario, where we have factored in a less steep growth curve in the regression model. In both scenarios we have applied a discount of 33% of the mathematical value to reflect the higher risk in Norsk Titanium relative to the peer groups.

Using a three-period model with margins gradually decreasing to approach a neutral ROIC – WACC spread in the terminal period, our DCF valuation returns NOK4.7 per share, using a WACC of 15%.

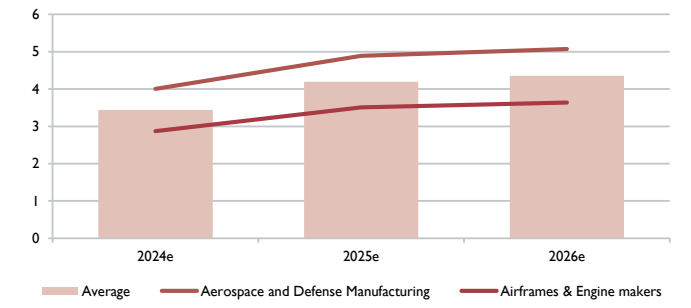
On our fair value range the shares are priced at an EV/EBITDA(26e) multiple of 5.9–9.2x. 9.2x is close to the median for the aerospace and defence manufacturers peer group, but below the main incumbent Howmet, which is valued at 16.6x for the same year.

Implied value/share based on regression, high end of FV range



Source: Carnegie Research

Implied value/share based on regression, low end of FV range



Source: Carnegie Research

EV/Sales	2024e	2025e	2026e
Aerospace and Defense	1.9	1.7	1.6
Airframes & Engine makers	1.6	1.4	1.2

Norsk Titanium	2024e	2025e	2026e
Fair value, low 3.5	18.2	5.5	1.7
Fair value, high, 5.4	28.1	8.8	2.6

Price. date: 2024-06-03 *Source: Factset, Car. Res.*

EV/EBITDA	2024e	2025e	2026e
Aerospace and Defense	15.5	11.4	9.8
Airframes & Engine makers	12.2	9.7	8.8

Norsk Titanium	2024e	2025e	2026e
Fair value, low 3.5	N.m.	N.m.	5.9
Fair value, high, 5.4	N.m.	N.m.	9.2

Price. date: 2024-06-03 *Source: Factset, Car. Res.*

EV/EBIT	2024e	2025e	2026e
Aerospace and Defense	16.2	14.4	13.1
Airframes & Engine makers	15.0	13.0	11.6

Norsk Titanium	2024e	2025e	2026e
Fair value, low 3.5	N.m.	N.m.	6.2
Fair value, high, 5.4	N.m.	N.m.	9.6

Price. date: 2024-06-03 *Source: Factset, Car. Res.*

Valuation and operational benchmarking of peer groups

Peer valuation table	Share price	EV	EV/S			EV/GP			EV/EBITDA			EV/(EBITDA - Capex)			EV/EBIT		
Company	Local	Current USD	2024e	2025e	2026e	2024e	2025e	2026e	2024e	2025e	2026e	2024e	2025e	2026e	2024e	2025e	2026e
Aerospace and Defense Manufacturing																	
Spirit Aerosystems	30.3	7,351	1.0	0.9	0.7	-93.2	9.4	6.8	3497.2	8.5	6.7	-44.2	10.9	8.1	-18.9	14.4	9.8
Hexcel	69.0	6,367	3.2	2.8	2.6	12.5	10.7	10.3	15.5	12.9	11.7	20.1	16.2	14.3	23.3	18.2	15.7
Triumph Group	13.9	1,774	1.4	1.3	1.2	5.1	4.1	3.7	9.9	7.9	6.8	11.4	8.9	7.5	13.4	9.8	8.2
TransDigm Group	1321.9	91,603	11.3	10.1	9.6	19.0	17.0	15.9	21.6	19.2	17.8	22.6	20.0	18.5	24.8	21.8	20.2
AVIC Xi'an Aircraft Ind	24.3	9,609	1.5	1.3	1.1	20.6	17.5	12.6	29.0	24.8	20.6	47.3	33.3	26.4	52.9	40.4	30.1
Avicopter	41.9	4,303	1.1	0.9	0.8	n.a.	n.a.	n.a.	35.9	29.9	24.6	57.1	44.7	36.2	53.0	42.8	35.0
Latecoere	0.0	74	0.7	0.7	n.a.	n.a.	n.a.	n.a.	17.4	17.0	n.a.	-31.5	-42.4	n.a.	-42.3	-43.7	n.a.
Senior	1.6	1,102	0.8	0.8	0.7	n.a.	n.a.	n.a.	7.6	6.6	5.4	12.7	11.0	9.1	14.3	11.4	9.3
Safran S.A.	213.8	96,308	3.3	2.8	2.5	13.7	11.7	10.1	17.0	14.3	12.3	22.5	18.4	15.5	22.2	17.9	15.3
AviChina	3.5	9,687	0.0	0.0	0.0	n.a.	n.a.	n.a.	0.1	0.5	0.4	0.2	0.6	n.a.	0.2	0.6	0.5
HEICO	215.1	32,394	7.1	6.5	6.1	18.1	16.2	n.a.	27.6	24.7	23.1	29.3	26.2	24.6	33.1	29.3	27.1
MTU Aero Engines	230.9	14,292	1.8	1.6	1.5	10.9	9.7	8.8	10.9	9.7	8.8	16.5	14.2	12.6	15.0	13.0	11.6
Rolls-Royce	4.5	50,897	2.3	2.0	1.8	11.5	9.7	8.7	13.9	11.4	10.1	19.4	15.5	13.5	20.0	15.7	13.5
CAE	25.4	8,184	2.4	2.3	2.2	8.6	n.a.	n.a.	10.4	9.2	8.6	16.4	14.1	13.2	16.2	13.9	12.7
Thales	164.3	41,773	1.9	1.7	1.6	6.9	6.1	5.5	12.0	10.6	9.6	15.6	13.6	12.1	15.7	13.7	12.1
Saab AB	240.0	12,034	2.1	1.8	1.6	9.6	7.9	7.0	15.8	12.9	10.9	28.7	20.9	16.2	22.8	18.2	15.2
Leonardo	23.1	18,028	0.9	0.8	0.8	8.1	7.0	6.1	7.8	6.8	5.9	13.0	10.9	9.2	11.5	9.6	8.2
Howmet Aerospace	84.2	37,741	5.1	4.6	4.2	18.4	16.5	15.4	21.2	18.6	16.6	25.6	21.8	19.3	25.2	21.8	19.2
Allegheny Technologies	61.2	9,503	2.0	1.8	1.7	9.1	7.8	6.8	12.1	10.0	8.8	17.3	13.0	11.0	14.9	11.8	10.6
Median			**1.9**	**1.7**	**1.6**	**10.9**	**9.7**	**8.7**	**15.5**	**11.4**	**9.8**	**17.3**	**14.2**	**13.5**	**16.2**	**14.4**	**13.1**
Mean			**2.6**	**2.4**	**2.3**	**5.3**	**10.8**	**9.1**	**199.1**	**13.4**	**11.6**	**15.8**	**14.3**	**15.7**	**16.7**	**14.8**	**15.2**
Airframes & Engine makers																	
Spirit Aerosystems	30.3	7,351	1.0	0.9	0.7	-93.2	9.4	6.8	3497.2	8.5	6.7	-44.2	10.9	8.1	-18.9	14.4	9.8
Safran S.A.	213.8	96,308	3.3	2.8	2.5	13.7	11.7	10.1	17.0	14.3	12.3	22.5	18.4	15.5	22.2	17.9	15.3
MTU Aero Engines	230.9	14,292	1.8	1.6	1.5	10.9	9.7	8.8	10.9	9.7	8.8	16.5	14.2	12.6	15.0	13.0	11.6
Rolls-Royce	4.5	50,897	2.3	2.0	1.8	11.5	9.7	8.7	13.9	11.4	10.1	19.4	15.5	13.5	20.0	15.7	13.5
Airbus	159.1	134,534	1.6	1.4	1.2	9.9	8.0	6.9	12.2	9.8	8.1	17.9	13.6	10.8	16.9	12.8	10.3
Embraer	36.7	6,680	0.9	0.8	0.7	4.9	4.1	3.5	8.7	6.8	5.7	12.5	9.2	8.5	13.5	9.7	7.9
Textron	86.3	18,890	1.2	1.2	1.1	6.6	6.3	5.9	10.2	9.5	9.1	13.3	12.3	11.7	12.6	12.1	11.7
Boeing	172.8	146,452	1.8	1.4	1.2	14.2	9.2	8.4	34.7	15.2	11.2	61.9	19.6	13.8	55.0	19.7	13.9
Bombardier	90.3	11,660	1.2	1.0	0.9	5.1	4.1	3.7	7.7	6.0	5.3	9.7	7.3	6.7	11.6	8.7	7.5
Median			**1.6**	**1.4**	**1.2**	**9.9**	**9.2**	**6.9**	**12.2**	**9.7**	**8.8**	**16.5**	**13.6**	**11.7**	**15.0**	**13.0**	**11.6**
Mean			**1.7**	**1.5**	**1.3**	**-1.8**	**8.0**	**7.0**	**401.4**	**10.1**	**8.6**	**14.4**	**13.5**	**11.3**	**16.4**	**13.8**	**11.3**

Price date: 2024-06-03

Source: Carnegie Research, FactSet

Operational benchmarking	Sales CAGR	Gross profit CAGR	EBITDA CAGR	Gross margin	EBITDA margin	EBITDA-Capex margin	EBIT margin	EBITDA margin
	24-26e	24-26e	24-26e	2026e	2026e	2026e	2026e	24-26e avg.
Aerospace and Defense Manufacturing								
Spirit Aerosystems	14.4%	n.a.	2136.1%	10.9%	11.1%	9.1%	7.5%	7.1%
Hexcel	10.1%	9.7%	14.8%	25.2%	22.3%	18.2%	16.5%	21.6%
Triumph Group	9.3%	14.9%	19.3%	31.0%	17.1%	15.5%	14.2%	15.8%
TransDigm Group	7.5%	8.1%	8.9%	60.3%	53.8%	51.8%	47.6%	53.0%
AVIC Xi'an Aircraft Industry	16.7%	28.2%	18.8%	8.6%	5.3%	4.1%	3.6%	5.2%
Avicopter	18.1%	n.a.	20.9%	n.a.	3.1%	2.1%	2.2%	3.0%
Latecoere	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Senior	6.3%	n.a.	15.8%	n.a.	12.7%	7.6%	7.4%	11.6%
Safran S.A.	12.0%	14.2%	15.5%	25.0%	20.6%	16.3%	16.6%	19.9%
AviChina	11.9%	n.a.	18.2%	n.a.	11.9%	n.a.	8.2%	11.0%
HEICO	6.8%	n.a.	7.9%	n.a.	26.3%	24.8%	22.5%	26.1%
MTU Aero Engines	9.0%	10.2%	10.3%	17.0%	17.1%	12.0%	13.0%	16.9%
Rolls-Royce	7.6%	9.9%	11.8%	20.4%	17.5%	13.1%	13.1%	17.0%
CAE	5.5%	n.a.	9.1%	n.a.	25.1%	16.3%	17.0%	24.4%
Thales	6.5%	8.9%	8.5%	28.5%	16.3%	12.9%	12.9%	16.1%
Saab AB	13.8%	15.3%	18.3%	22.4%	14.3%	9.6%	10.3%	13.8%
Leonardo	5.5%	10.7%	10.3%	12.5%	12.9%	8.3%	9.3%	12.3%
Howmet Aerospace	9.5%	8.9%	12.6%	27.4%	25.4%	21.9%	22.0%	24.8%
Allegheny Technologies	6.9%	12.8%	14.8%	24.6%	19.2%	15.3%	15.9%	18.0%
Median	**9.1%**	**10.4%**	**14.8%**	**24.6%**	**17.1%**	**13.1%**	**13.0%**	**16.5%**
Mean	**9.9%**	**12.6%**	**131.8%**	**24.2%**	**18.4%**	**15.2%**	**14.4%**	**17.6%**
Airframes & Engine makers								
Spirit Aerosystems	14.4%	n.a.	2136.1%	10.9%	11.1%	9.1%	7.5%	7.1%
Safran S.A.	12.0%	14.2%	15.5%	25.0%	20.6%	16.3%	16.6%	19.9%
MTU Aero Engines	9.0%	10.2%	10.3%	17.0%	17.1%	12.0%	13.0%	16.9%
Rolls-Royce	7.6%	9.9%	11.8%	20.4%	17.5%	13.1%	13.1%	17.0%
Airbus	12.5%	15.6%	19.1%	17.3%	14.8%	11.0%	11.6%	14.1%
Embraer	10.1%	11.9%	16.9%	19.8%	12.2%	8.1%	8.8%	11.6%
Textron	4.1%	6.1%	5.5%	19.5%	12.6%	9.8%	9.7%	12.4%
Boeing	15.1%	23.8%	67.6%	14.5%	10.9%	8.8%	8.8%	8.5%
Bombardier	4.9%	9.0%	11.7%	25.7%	17.9%	14.1%	12.7%	17.0%
Median	**10.1%**	**11.0%**	**15.5%**	**19.5%**	**14.8%**	**11.0%**	**11.6%**	**14.1%**
Mean	**10.0%**	**12.6%**	**254.9%**	**18.9%**	**15.0%**	**11.4%**	**11.3%**	**13.8%**

Price date: 2024-06-03

Source: Carnegie Research, FactSet

Regression-based valuation based on EV/sales

Comparing companies in different stages of growth is a difficult task. Since Norsk Titanium's revenues is in a step ramp-up phase, we have based our regression model on the peer group's 2024−26e numbers and Norsk Titanium's revenue growth for the same period. As two-year revenue growth is not the sole factor that determines value in a regression model, we also include EBITDA margin for 2026e in our regression model. 2026e is the year when Norsk Titanium, according to our estimates, will be profitable and reach self-financing. It is therefore the key performance indicator to use in the relative valuation, in our view.

In this context we compare Norsk Titanium with two sets of peer groups: aerospace & defence manufacturers and airframe & engine makers. These industries share the same value drivers as Norsk Titanium, in our view. We have not included 3D printing companies in our valuation framework as we view these as focused on machine sales of 3D printing equipment rather than part sales, and thus less relevant. Based on our current estimates the regression model returns the high end of our fair value range.

Summary of Norsk Titanium's P&L and CF items using our regression valuation

	2024e	2025e	2026e	2027e	2028e	2029e	2030e
Sales	14	43	151	207	284	390	495
EBITDA	-23	-11	44	52	71	97	124
EBIT	-25	-13	42	48	67	92	118
EPS	-0.05	-0.02	0.04	0.05	0.07	0.09	0.11
FCF	-27	-22	7	30	30	35	39

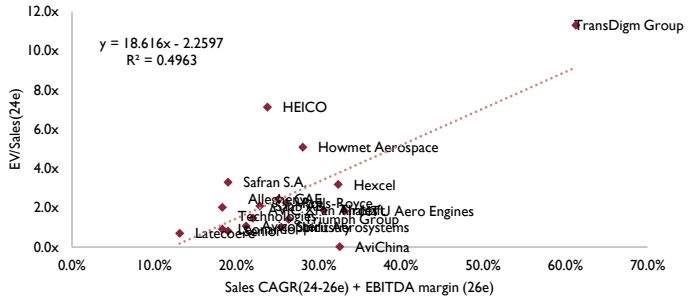
Source: Carnegie Research

Our regression model, which is a correlation between EV/sales and the combined two-year sales growth plus EBITDA margin in year 3, is therefore:

EV/sales(t) = Intercept + Slope x (CAGR(t+2)/(t)+ EBITDA margin(t+2))

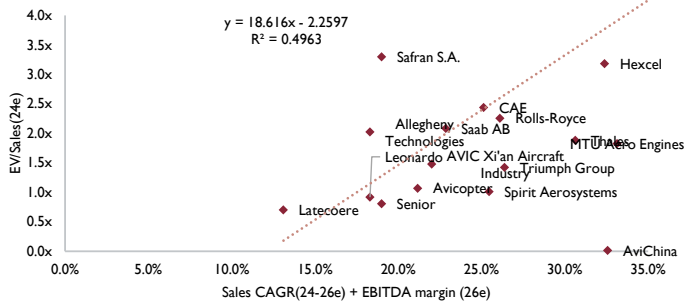
If we use our Norsk Titanium estimates for 2026 as an illustration, and plug in the numbers of the first peer group shown below (aerospace and defence manufacturing , unadjusted chart to the left, chart adjusted for outliers to the right), we get an EV/sales of 44.6x in 2024e. Norsk Titanium's CAGR revenue growth in 2024−26e would be 223%, and EBITDA margin in 2026e would reach 29%. Plugging in these values, we get -2.3 + 18.6 x (223% + 29%) = 44.6x.

Aerospace and Defense: EV/Sales vs. Sales CAGR + EBITDA margin



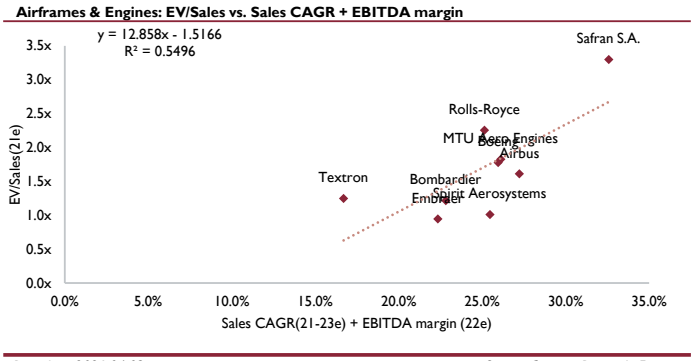
Price date: 2026-04-03 *Source: Carnegie Research, Factset*

Aerospace and Defense: EV/Sales vs. Sales CAGR + EBITDA margin

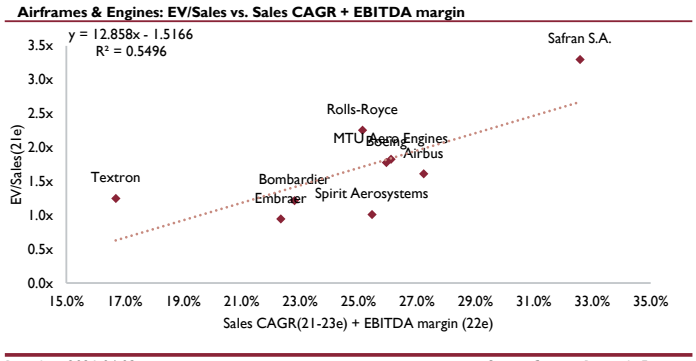


Price date: 2026-04-03 *Source: Carnegie Research, Factset*

Below is the regression for Airframes and Engine makers, unadjusted chart to the left and chart with adjusted scale to the right:



Price date: 2026-04-03 *Source: Carnegie Research, Factset*



Price date: 2026-04-03 *Source: Carnegie Research, Factset*

We have carried our calculations, similar to those described above, for each of the years 2024e–26e for the two peer groups. The result is outlined in the table below. The regression model's explanatory power is strongest for the peer group airframe & engine makers, with R-squared above 50%, and lower for aerospace & defence manufacturers.

We have applied a discount of 33% to our calculated value. The risk in Norsk Titanium is, in our view, significantly higher than at peers; the peer group consists of large US corporations with substantial track records. A sensitivity table for different discount values and the implied valuation is supplied below.

Regression: Peer groups EV/S(24e) vs Sales CAGR(24-26e) + EBITDA margin(26e)

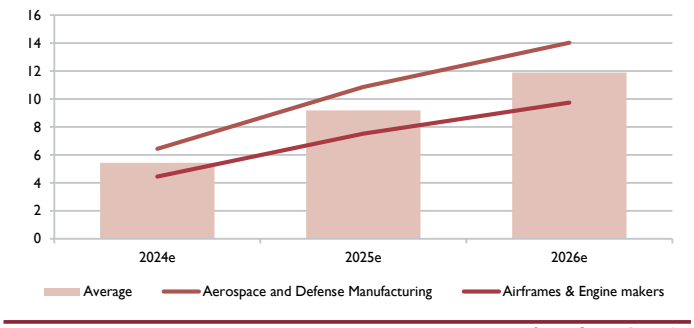
	Sales CAGR	EBITDA margin (t+2)	Sales CAGR + EBITDA margin	Aerospace and Defense	Airframes & Engine makers	Average
Slope				18.6	12.9	
Intercept				-2.3	-1.5	
R-square				50%	55%	
NTI's regression-based EV/Sales multiples						
NTI 2024e & fair EV/Sales	223%	29%	252%	44.6x	30.9x	37.8x
NTI 2025e & fair EV/Sales	120%	29%	149%	25.4x	17.6x	21.5x
NTI 2026e & fair EV/Sales	37%	25%	62%	9.3x	6.5x	7.9x

Implied NTI share price based on year	Revenues (USDm)	EBITDA (USDm)	Value/share based on a 33% discount factor		
2024e	14	-23	6	4	5.4
2025e	43	-11	11	8	9.2
2026e	151	44	14	10	11.9

Price date: 2024-06-03 *Source: Carnegie Research*

Below is a summary of calculated values in different years and a sensitivity table using different discount levels.

Implied value/share based on regression, high end of FV range



Source: Carnegie Research

	Discount		
Year	**0%**	**33%**	**50%**
2024e	7.2	5.4	4.8
2025e	12.2	9.2	8.1
2026e	15.8	11.9	10.5

Source: Carnegie Research

Regression valuation – low end of fair value range

To reach the low end of our fair value range, we have used the slower ramp-up scenario addressed under the Estimates section, and then used 20% topline growth and 20% EBITDA margin in the following years. The regression model is unchanged relative to the high end of the fair value range.

Regression: Peer groups EV/S(26e) vs Sales CAGR(24-26e) + EBITDA margin(26e)

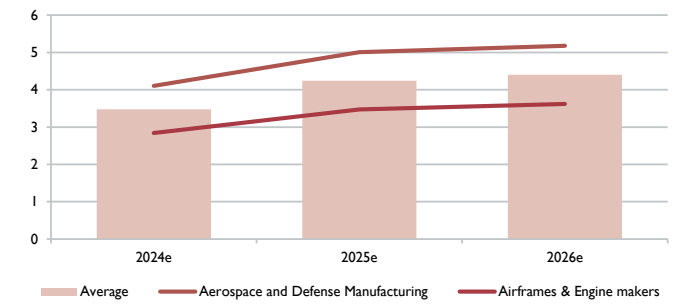
	Sales CAGR	EBITDA margin (t+2)	Sales CAGR + EBITDA margin	Aerospace and Defense	Airframes & Engine makers	Average
Slope				18.6	12.9	
Intercept				-2.3	-1.5	
R-square				50%	55%	
NTI's regression-based EV/Sales multiples						
NTI 2024e & fair EV/Sales	170%	3%	173%	29.9x	20.7x	25.3x
NTI 2025e & fair EV/Sales	91%	3%	94%	15.2x	10.6x	12.9x
NTI 2026e & fair EV/Sales	20%	20%	40%	5.2x	3.6x	4.4x

Implied NTI share price based on year	**Revenues (USDm)**	**EBITDA (USDm)**	**Value/share based on a 33% discount factor**		
2024e	14	-23	4	3	3.5
2025e	33	-18	5	3	4.2
2026e	100	3	5	4	4.4

Price date: 2024-06-03

Source: Carnegie Research

Implied value/share based on regression, low end of FV range

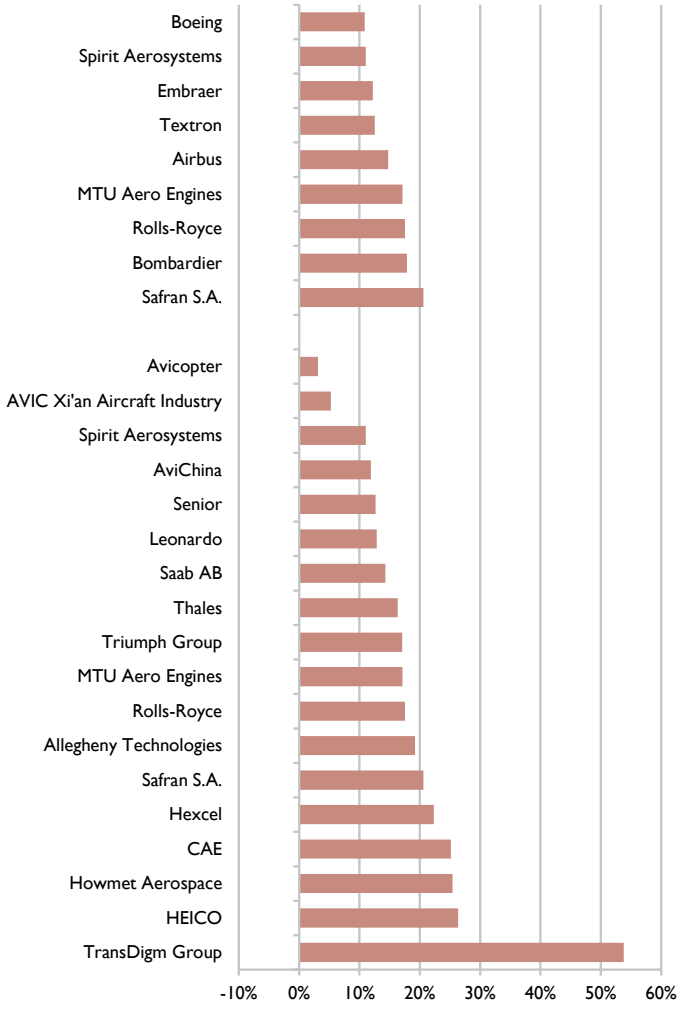


Source: Carnegie Research

	Discount		
Year	**0%**	**33%**	**50%**
2024e	4.6	3.5	3.1
2025e	5.6	4.2	3.8
2026e	5.9	4.4	3.9

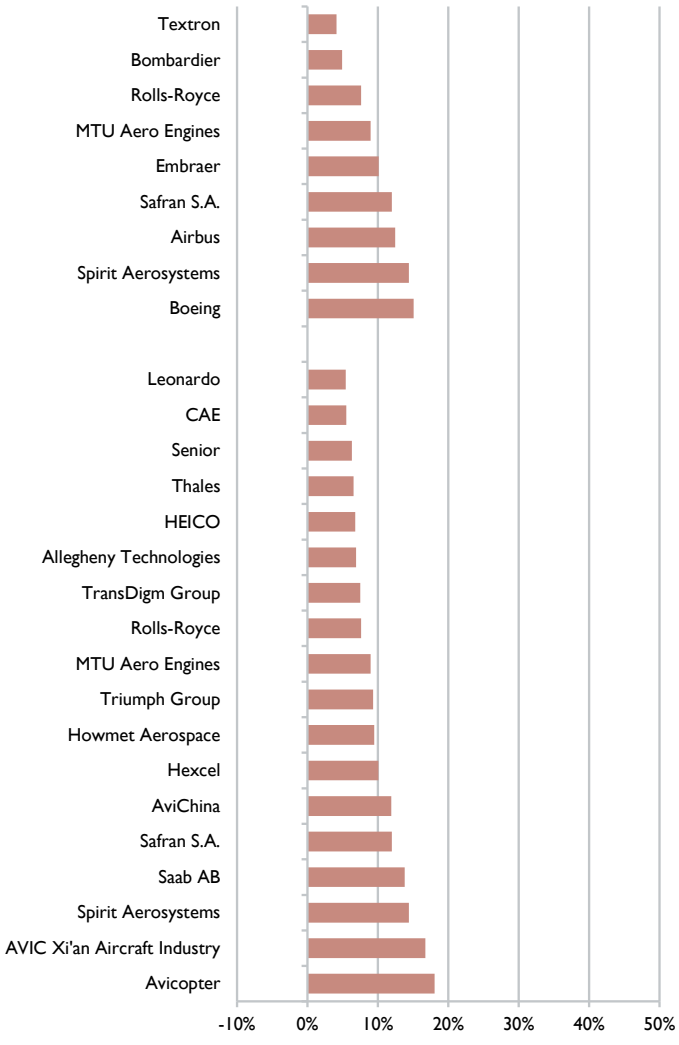
Source: Carnegie Research

EBITDA margins 2026e



Source: Factset, Carnegie Research

Sales CAGR 24-26e



Source: Factset, Carnegie Research

DCF valuation

Our 2021−40 estimates are shown in the table below. Our estimates are based on:

- Explicit estimates for 2024−26e, 35% annual revenue growth in 2026−29e and a diminishing growth rate in 2030−40e, starting at 25% in 2030 and reaching 7% in 2040e to end up at 3% in the terminal value calculation.
- EBITDA margin of close to 30% in 2026e and then 25% for the rest of the period, with 10% in our terminal value calculation to simulate normalised profitability.
- No growth capex until 2028, but growth capex thereafter to handle increasing production
- Limited payable tax until 2029 due to tax losses carried forward, and a payable tax rate of 23% thereafter.
- We have adjusted the cost of equity to reflect NTI's higher risk than the average stock; albeit traded at a low beta. Norsk Titanium stock is traded at high volatility, with 52-week volatility well above 200%, implying significantly higher risk in Norsk Titanium relative to the average listed stock.

Based on our estimates and a cost of equity of 15%, we get a DCF value per share of NOK4.7.

				Average year				Terminal
DCF assumptions - Summary	**2024e**	**2025e**	**2026e**	**4-5**	**6-10**	**11-15**	**16-20**	**period**
Total sales growth	479%	196%	253%	35%	23%	13%	6%	3%
EBITDA margin	-156%	-25%	29%	25%	25%	25%	22%	10%
Depreciation % of sales	-14%	-5%	-1%	-2%	-1%	-1%	-2%	-2%
EBITA margin	-170%	-30%	27%	23%	24%	24%	20%	8%
Amortisations % of sales	0%	0%	0%	0%	0%	0%	0%	0%
EBIT margin	-170%	-30%	27%	23%	24%	24%	20%	8%
Capex % of sales	-7%	-5%	-1%	-3%	-5%	-3%	-2%	-2%
Paid tax rate	5%	5%	5%	-6%	-19%	-23%	-23%	-23%
NWC to sales	-11%	19%	22%	32%	32%	32%	32%	32%
Sales	14	43	151	240	565	1,143	1,698	1,925
EBITDA	**-23**	**-11**	**44**	**60**	**141**	**286**	**368**	**193**
Capex	-1	-2	-2	-7	-25	-31	-31	-34
Taxes	0	-1	-2	-3	-28	-63	-78	-36
Other	-3	-9	-32	-28	-32	-40	-31	690
Free cash flow	**-27**	**-22**	**7**	**22**	**56**	**152**	**229**	**812**
Discounted FCF	-25	-18	5	12	19	26	21	53
Share of total discounted FCF	-7%	-5%	1%	7%	26%	35%	28%	15%

Valuation	**USDm**	**Per share**	**NOK**
EV (discounted FCF)	365	0.5	4.8
- Net debt (2023)	-5	0.0	-0.1
+ Associates	0	0.0	0.0
- Minority interest	0	0.0	0.0
- Outstanding warrants	-28	0.0	-0.4
Other debt adjustments	0	0.0	0.0
ESG penalty	0	0.0	0.0
Equity value at YE (23)	**332**	**0.4**	**4.4**
Time adjustment	19	0.0	0.3
Dividend	0	0.0	0.0
Current equity value	**351**	**0.4**	**4.7**

WACC assumptions	
Risk free interest rate	4.0%
Debt risk premium	0.5%
Equity risk premium	4.0%
Equity beta	2.75
Cost of Equity	**15.0%**
Tax rate	-23.0%
After tax cost of debt	5.5%
Equity weight	100%
WACC	**15.0%**

Source: Carnegie Research

Sensitivities

The DCF-value is highly sensitive to different values for EBITDA margin in the terminal value period and the WACC. The table below contains different DCF values in NOK per share depending on these two variables.

		EBITDA-margin, terminal value				
		6%	8%	10%	12%	14%
WACC	12%	6.1	6.5	6.9	7.3	7.7
	13%	5.4	5.7	6.1	6.4	6.8
	14%	4.7	5.0	5.3	5.6	5.9
	15%	4.2	4.4	4.7	4.9	5.2
	16%	3.7	3.9	4.1	4.3	4.5
	17%	3.2	3.4	3.6	3.8	4.0
	18%	2.9	3.0	3.2	3.3	3.5
	19%	2.2	2.4	2.5	2.6	2.7

Source: Carnegie Research

The five-year perspective in multiples valuation

We base our valuation on our estimates for 2026. One could argue that this does not take the longer-term view into account from a multiple valuation perspective. We have therefore created a sensitivity table to display how different sales values could be valued by the market, and which share price this corresponds to. The basis is our projection for 2029e of USD390m (highlighted in the table) with deviation from USD -100m to +USD200m and EV/S multiples ranging from 0.5x to 4.0x.

For example, in the lower right corner, NTI would generate USD590m in sales in 2029e and be valued at EV/S 4x. This would generate a valuation of NOK 15.6 per share today, given a cost of equity (CoE) of 15%.

Simulation of long-term sales projections and EV/S multiples

	Implied EV 2029e based on EV/Sx 1-4							
Sales projection, USDm	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
290	145	290	435	580	725	870	1,015	1,160
390	195	390	585	780	975	1,170	1,365	1,560
490	245	490	735	980	1,225	1,470	1,715	1,960
590	295	590	885	1,180	1,475	1,770	2,065	2,360

	Implied EV today based on EV/Sx 1-4 & 15% CoE							
Sales projection, USDm	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
290	72	144	216	288	360	433	505	577
390	97	194	291	388	485	582	679	776
490	122	244	365	487	609	731	853	974
590	147	293	440	587	733	880	1,027	1,173

	Implied share price today based EV/Sx 1-4 & 15% CoE							
Sales projection, USDm	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
290	1.0	1.9	2.9	3.8	4.8	5.7	6.7	7.7
390	1.3	2.6	3.9	5.2	6.4	7.7	9.0	10.3
490	1.6	3.2	4.9	6.5	8.1	9.7	11.3	12.9
590	1.9	3.9	5.8	7.8	9.7	11.7	13.6	15.6

Source: Carnegie Research

Sustainability

The entire value proposition of using RPD® technology is based on sustainability relative to the traditional process of producing titanium parts. Below we list the major drivers:

RPD® is highly material- and energy-efficient

The RPD® process saves up to 75% of raw materials and energy relative to the traditional forging and machining production process according to NTI. Savings come in many forms, but the main drivers are no need for heat in the forging process, and adding material rather than removing it means that the need for significant machining of metal is much less to the forging and machining process.

Titanium parts save weight and reduce corrosion

Titanium parts are highly efficient in saving resources throughout the value chain in the aerospace and defence industry. Less weight saves fuel and enables more use of other light-weight material such as composites, as titanium is less corrosive than the traditional material used, aluminium.

The use of software reduces lead times

The production process is highly digitalised, with extensive use of e.g. CAD software, which reduces both lead times and the need to send prototypes back and forth, thereby reducing transportation costs and environmental footprint.

Less machining time reduces the need for labour

As populations age so labour becomes more scarce, which is a particular challenge in manufacturing. The RPD® is not labour intensive, which increases productivity and therefore helps the economy.

The RPD® process can reduce CO2 emissions up to 30%

According to Norsk Titanium, the RPD® process can reduce CO2 emissions by 30% relative to the incumbent process. This is important as global commercial aerospace is a material contributor to greenhouse gas emissions, ranked as part of industry number nine, Aviation and Shipping, on Our World in Data's 2022 list of the ten most polluting industries.

SWOT

Here we summarise the investment case in Norsk Titanium through a SWOT analysis.

Strengths

- Disruptive technology protected by >190 patents and deep inventory of production and testing data
- Agreements for serial production with commercial aerospace industry major OEM's Boeing and Airbus
- Serial production with semiconductor industry participants such as ASML/Hittech
- Strong market backdrop in the aerospace and defence industry
- Sourcing of titanium metal is an increasing challenge that is leading to opportunities for material efficient technologies
- Strong scalability and low investment needs

Weakness

- No track record of recurring revenues
- Limited capital base if our estimates miss
- Dependency on a few customers, e.g. ASML/Hittech, Boeing and Airbus
- Exposure to raw material fluctuations in the cost base

Opportunities

- More rapid expansion into high growth industries such as semiconductors
- Breakthrough into the defence industry with announced contracts for significant serial production
- New industries, e.g. medical
- Ability to sell the IP technology to other part manufacturers for new revenue streams, e.g. royalties

Threats

- Competitors inventing similar production methods that bypass the current strong IP protection
- Delivered parts causing accident in customer's products
- A major downturn in the commercial aerospace industry

Key risks to the case

In our view, the biggest challenge for Norsk Titanium is to scale up production fast enough to reach cash flow breakeven. Its prospects are bright, given the impressive client list of Tier 1 supply agreements with commercial aircraft majors signed recently, as well as its technology's strong entry barriers. Nevertheless, Norsk Titanium's target is to increase revenues by a factor of ~10x in just 24 months, based on guidance for 2024 of USD15m in revenues and USD150m in 2026e, and with a 30% EBITDA(26e) margin. Such a ramp-up would be a major task for any company, and with around 100 employees, the challenge is striking for Norsk Titanium.

Regulatory risk is low as Norsk Titanium is already at the approved supplier stage with both Boeing and Airbus, and has existing serial production with these two companies. However, the company is likely to need additional approval for every new 'component family' it produces for the aviation and defence industries. This could lead to uncertainty for future production goals and estimates, and consequently for valuation.

In addition, if competing AM producers and technologies can produce at the same forging grade quality as Norsk Titanium – thus being able to obtain related qualifications – this could translate to price and competition pressures, leading to significant downward pressure on margins.

Due to Norsk Titanium's operational leverage, where we expect COGS at around 50%, EBITDA margins could also be negatively affected by lower sales volumes.

Currently, we expect the upcoming exercise of warrants to bridge the gap to cash-flow breakeven situation. However, an unsuccessful outcome of the warrant exercise could trigger additional cash flow needs.

Any weak performance in securing orders or longer qualification periods could increase future funding needs.

Although less so than many incumbents, Norsk Titanium is still dependent on raw material supply and prices, especially titanium wire. Given the current distribution of production, with more than 50% of global supply in Russia and China, sudden price changes and/or administrative trade barriers regarding supply could have a major impact on costs. This would hit all industry players, but poses a particular risk to Norsk Titanium given its tight cash situation.

Lastly, there is limited visibility on revenue forecasts as we do not know the exact date for full commercialisation and related contracts for Norsk Titanium.

Management and board

We note the broad experience and long tenure of both the management team and the board of directors.

Highly experienced management team

Carl Johnson, Chief Executive Officer

Joined in 2016 as Chief Technical Officer and became Chief Executive Officer and President in November 2023. He has over 40 years of experience in the aerospace industry. His career includes leading teams in advanced technologies. In his 30+ years with Northrop Grumman, he led the Global Hawk Autonomous Unmanned Air System, Triton UAS, and the X-47B UAS which demonstrated autonomous carrier take off and landings and autonomous aerial Refueling. Prior to these roles he held various management positions in the B-2 program.

Ashar A. Ashary, Chief Financial Officer

Joined in 2016, currently serving as Chief Financial Officer. Prior to joining the Company Mr. Ashary was with Tricap Investments, a private equity fund associated with the investment in Norsk Titanium. Mr. Ashary spent over 15 years in private equity, investment banking and advisory where he led technology and growth investment teams, and held senior finance positions at growth companies of private equity firms.

Gail A. Balcerzak, Chief Legal and People Officer

Joined in October 2022 as Vice President and General Counsel. In 2022, she was appointed Chief Legal and People Officer, overseeing the global legal and human resources functions for the Company. Ms. Balcerzak has over 20 years' in-house legal experience with global technology-driven companies in positions of increasing responsibility. Prior to joining the Company, she held the position of Deputy General Counsel at Hexcel Corporation and was responsible for all legal matters for Hexcel's $1.2B Americas Aerospace division.

Steve Eaton, VP Operations

Joined in June 2017 and became VP Operations in 2020. He played a key role in establishing operations in Plattsburgh. Mr. Eaton previously worked at Collins Aerospace as Director of Military Programs responsible for all aspects of program execution and business development. In total, Mr. Eaton has worked in Aerospace and Defense for over 20 years with increasing responsibilities ranging from operations, continuous improvement, compliance and operations finance at Collins Aerospace, United Technologies and Raytheon Defense Systems.

Odd Terje Lium, VP Engineering

Joined in 2018, leading our Eggemoen Technology Center. Mr. Lium has more than 20 years of experience in the aerospace industry, as a leader in both technology development and production. Prior to joining Norsk Titanium, Mr. Lium held the position as VP Engineering Technology Quality at GKN Aerospace Norway AS.

Nicholas Mayer, VP Commercial

Joined in 2015 as the Vice President of Product Development and was appointed Vice President of Commercial in 2020, overseeing all customer relationships, product development and pricing, communications, and marketing. Prior to joining Norsk Titanium, Mr. Mayer held management positions within the advanced development divisions of Northrop Grumman, Aerojet Rocketdyne, and Lockheed Martin.

Khazeem Adesokan, VP Quality

Joined in 2022 as Vice President of Quality, overseeing the global quality organization. Prior to joining Norsk Titanium, Mr. Adesokan was employed by Pratt & Whitney, a Raytheon Technologies Company, for 17 years where he held various leadership positions within the organization.

Source: Norsk Titanium

Board of Directors

Source: Norsk Titanium

Shareholders	Capital	Votes
White Crystals LTD	28.20%	28.20%
Scatec Innovation AS	18.04%	18.04%
Triangle Holdings LP	11.92%	11.92%
Disruptive Innovation Fund L.P.	6.84%	6.84%
Norsk Titanium Cayman Limited	5.41%	5.41%
MP Pensjon PK	3.23%	3.23%
Arne Blystad	2.52%	2.52%
Avkast Invest AS	1.95%	1.95%
Ferd AS	1.94%	1.94%
Nordnet Livsforsikring AS	1.29%	1.29%

Source: Holdings, Carnegie Research

Financial statements

Profit & loss (USDm)	2017	2018	2019	2020	2021	2022	2023	2024e	2025e	2026e
Sales	0	8	0	1	6	3	3	14	43	151
COGS	0	-6	-3	-4	-4	-4	-5	-13	-26	-76
Gross profit	**0**	**2**	**-3**	**-3**	**2**	**0**	**-3**	**1**	**17**	**76**
Other income & costs	0	3	-28	-24	-18	-18	-21	-24	-28	-32
Share in ass. operations and JV	0	0	0	0	0	0	0	0	0	0
EBITDA	**0**	**5**	**-31**	**-27**	**-17**	**-19**	**-23**	**-23**	**-11**	**44**
Depreciation PPE	0	-3	-4	-3	-3	-2	-2	-2	-2	-2
Depreciation lease assets	0	0	0	0	0	0	0	0	0	0
Amortisation development costs	0	0	0	0	0	0	0	0	0	0
Amortisation other intangibles	0	0	0	0	0	0	0	0	0	0
Impairments / writedowns	0	0	0	0	0	0	0	0	0	0
EBITA	**0**	**2**	**-35**	**-30**	**-20**	**-21**	**-25**	**-25**	**-13**	**42**
Amortization acquisition related	0	0	0	0	0	0	0	0	0	0
Impairment acquisition related	0	0	0	0	0	0	0	0	0	0
EBIT	**0**	**2**	**-35**	**-30**	**-20**	**-21**	**-25**	**-25**	**-13**	**42**
Share in ass. operations and JV	0	0	0	0	0	0	0	0	0	0
Net financial items	0	0	0	0	-1	12	-1	0	0	0
of which interest income/expenses	0	0	0	0	-1	0	0	0	0	0
of which interest on lease liabilities	0	0	0	0	0	0	0	0	0	0
of which other items	0	na	na	na	na	na	na	na	na	na
Pre-tax profit	**0**	**2**	**-35**	**-30**	**-21**	**-9**	**-27**	**-25**	**-13**	**42**
Taxes	0	0	0	0	0	0	0	0	0	-10
Post-tax minorities interest	0	0	0	0	0	0	0	0	0	0
Discontinued operations	0	0	0	0	0	0	0	0	0	0
Net profit	**0**	**2**	**-35**	**-30**	**-21**	**-9**	**-27**	**-25**	**-13**	**32**
Adjusted EBITDA	0	5	-31	-27	-17	-19	-23	-23	-11	44
Adjusted EBITA	0	2	-35	-30	-20	-21	-25	-25	-13	42
Adjusted EBIT	0	2	-35	-30	-20	-21	-25	-25	-13	42
Adjusted net profit	0	2	-35	-30	-21	-9	-27	-25	-13	32
Sales growth Y/Y	na	+chg	-95.0%	151.3%	463.8%	-41.5%	-22.5%	477.9%	196.0%	252.7%
EBITDA growth Y/Y	na	+chg	-chg	+chg	+chg	-chg	-chg	+chg	+chg	+chg
EBITA growth Y/Y	na	+chg	-chg	+chg	+chg	-chg	-chg	+chg	+chg	+chg
EBIT growth Y/Y	na	+chg	-chg	+chg	+chg	-chg	-chg	+chg	+chg	+chg
EBITDA margin	nm	61.5%	na	na	-303.3%	-582.4%	na	-155.9%	-25.4%	28.8%
EBITA margin	nm	29.5%	nm	nm	nm	nm	nm	nm	nm	27.5%
EBIT margin	nm	29.5%	na	na	-364.3%	-653.7%	na	-169.7%	-30.1%	27.5%
Tax rate	na	-5.4%	-5.4%	-5.4%	-5.4%	-5.4%	-5.4%	-5.4%	-5.4%	-5.4%

Cash flow (USDm)	2017	2018	2019	2020	2021	2022	2023	2024e	2025e	2026e
EBITDA	0	5	-31	-27	-17	-19	-23	-23	-11	44
Paid taxes	0	0	0	0	0	0	0	0	-1	-2
Change in NWC	0	3	3	0	-4	-1	1	-3	-9	-32
Non cash adjustments	0	0	0	0	0	0	0	0	0	0
Discontinued operations	0	0	0	0	0	0	0	0	0	0
Total operating activities	**0**	**7**	**-27**	**-27**	**-21**	**-20**	**-22**	**-26**	**-20**	**9**
Capex tangible assets	0	0	0	-1	0	-1	0	-1	-2	-2
Capitalised development costs	0	0	0	0	0	0	0	0	0	0
Capex - other intangible assets	0	0	0	0	0	0	0	0	0	0
Acquisitions/divestments	0	0	0	0	0	0	0	0	0	0
Other non-cash adjustments	0	0	0	0	0	0	0	0	0	0
Total investing activities	**0**	**0**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**-2**	**-2**
Net financial items	0	0	0	0	-1	12	-1	0	0	0
Lease payments	0	na	na	na	na	na	na	na	na	na
Dividend paid and received	0	na	na	na	na	na	na	na	na	na
Share issues & buybacks	0	5	0	0	39	7	8	61	0	0
Change in bank debt	0	0	0	0	0	0	0	0	0	0
Other cash flow items	0	na	na	na	na	na	na	na	na	na
Total financing activities	**0**	**36**	**10**	**28**	**42**	**19**	**15**	**56**	**0**	**0**
Operating cash flow	0	7	-27	-27	-21	-20	-22	-26	-20	9
Free cash flow	0	8	-27	-28	-22	-8	-24	-27	-22	7
Net cash flow	0	44	-17	0	20	-2	-8	29	-22	7
Change in net IB debt	0	12	-28	-28	16	-3	-16	34	-22	7
Capex / Sales	nm	-5.3%	35.9%	73.5%	6.4%	17.0%	12.0%	6.9%	4.7%	1.3%
NWC / Sales	nm	0.0%	-2037.2%	-1295.9%	-70.7%	69.7%	27.2%	-10.4%	7.4%	13.5%

Source: Carnegie Research & company data

Financial statements, cont.

Balance sheet (USDm)	2017	2018	2019	2020	2021	2022	2023	2024e	2025e	2026e
Acquired intangible assets	0	0	0	0	0	0	0	0	0	0
Other fixed intangible assets	0	0	9	8	6	4	3	3	3	3
Capitalised development	0	0	0	0	0	0	0	0	0	0
Tangible assets	0	na	7	6	5	6	5	4	4	4
Lease assets	0	0	0	0	0	0	0	0	0	0
Other IB assets (1)	0	0	0	0	0	0	0	0	0	0
Other non-IB assets	0	0	0	0	0	0	0	0	0	0
Fixed assets	**0**	**0**	**17**	**14**	**11**	**10**	**8**	**7**	**7**	**7**
Inventories (2)	0	0	4	5	5	5	6	10	13	45
Receivables (2)	0	0	1	1	0	1	1	4	12	20
Prepaid exp. & other NWC items (2)	0	0	2	1	3	3	1	4	8	12
IB current assets (1)	0	0	0	0	0	0	0	0	0	0
Other current assets	0	0	0	0	0	0	0	0	0	0
Cash & cash equivalents (1)	0	0	2	2	23	8	1	30	7	14
Current assets	**0**	**0**	**9**	**9**	**31**	**17**	**9**	**48**	**40**	**91**
Total assets	**0**	**0**	**26**	**23**	**42**	**27**	**17**	**55**	**47**	**98**
Shareholders' equity	0	0	-37	-81	34	17	-1	35	22	54
Minorities	0	0	0	0	0	0	0	0	0	0
Other equity	0	0	0	0	0	0	0	0	0	0
Total equity	**0**	**0**	**-37**	**-81**	**34**	**17**	**-1**	**35**	**22**	**54**
Deferred tax	0	0	0	0	0	0	0	0	0	0
LT IB debt (1)	0	0	42	89	0	2	0	0	0	0
Other IB provisions (1)	0	0	0	0	0	0	0	0	0	0
Lease libilities	0	0	0	0	0	0	0	0	0	0
Other non-IB liabilities	0	0	0	0	1	1	2	0	0	0
LT liabilities	**0**	**0**	**42**	**89**	**1**	**3**	**2**	**0**	**0**	**0**
ST IB debt (1)	0	0	0	0	0	1	6	0	0	0
Payables (2)	0	0	2	2	1	1	2	6	8	16
Accrued exp. & other NWC items (2)	0	0	20	14	5	5	7	14	17	29
Other ST non-IB liabilities	0	0	0	0	0	0	0	0	0	0
Liabilities - assets held for sale	0	0	0	0	0	0	0	0	0	0
Current liabilities	**0**	**0**	**23**	**16**	**7**	**7**	**16**	**20**	**25**	**44**
Total equity and liabilities	**0**	**0**	**28**	**25**	**42**	**27**	**17**	**55**	**47**	**98**
Net IB debt (=1)	0	0	40	87	-22	-6	5	-30	-7	-14
Net working capital (NWC) (=2)	0	0	-16	-10	2	3	-1	-2	8	33
Capital employed (CE)	0	0	5	9	36	20	8	35	22	54
Capital invested (CI)	0	na	1	5	13	13	7	5	15	40
Equity / Total assets	nm	nm	-145%	-350%	81%	65%	-6%	64%	47%	55%
Net IB debt / EBITDA	nm	0.0	-1.3	-3.2	1.3	0.3	-0.2	1.3	0.7	-0.3

Per share data (USD)	2017	2018	2019	2020	2021	2022	2023	2024e	2025e	2026e
Adj. no. of shares in issue YE (m)	0.00	0.00	0.00	0.00	211.9	239.7	270.0	790.0	790.0	790.0
Diluted no. of Shares YE (m)	0.00	0.00	0.00	0.00	211.9	239.7	270.0	790.0	790.0	790.0
EPS	na	na	na	na	-0.20	-0.04	-0.10	-0.05	-0.02	0.04
EPS adj.	na	na	na	na	-0.20	-0.04	-0.10	-0.05	-0.02	0.04
CEPS	na	na	na	na	-0.17	-0.03	-0.10	-0.04	-0.01	0.04
DPS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BVPS	na	na	na	na	0.16	0.07	0.00	0.04	0.03	0.07

Performance measures	2017	2018	2019	2020	2021	2022	2023	2024e	2025e	2026e
ROE	nm	nm	186.6%	51.6%	90.6%	-35.2%	-325.9%	-144.2%	-45.0%	83.7%
Adj. ROCE pre-tax	na	na	na	-442.3%	-91.3%	-31.2%	-186.0%	-114.7%	-45.0%	108.7%
Adj. ROIC after-tax	na	na	na	-1161.7%	-242.7%	-175.3%	-276.0%	-431.8%	-133.4%	159.7%

Valuation	2017	2018	2019	2020	2021	2022	2023	2024e	2025e	2026e
FCF yield	0.0%	3.5%	-12.5%	-12.8%	-10.2%	-3.7%	-10.9%	-12.3%	-10.2%	3.2%
Dividend yield YE	na	na	na	na	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dividend payout ratio	na	na	na	na	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dividend + buy backs yield YE	na	na	na	na	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EV/Sales YE	na	na	na	na	13.27	11.37	25.05	13.12	4.95	1.36
EV/EBITDA YE	na	na	na	na	neg.	neg.	neg.	neg.	neg.	4.7
EV/EBITA YE	na	na	na	na	neg.	neg.	neg.	neg.	neg.	4.9
EV/EBITA adj. YE	na	na	na	na	neg.	neg.	neg.	neg.	neg.	4.9
EV/EBIT YE	na	na	na	na	neg.	neg.	neg.	neg.	neg.	4.9
P/E YE	na	na	na	na	nm	nm	nm	nm	nm	6.9
P/E adj. YE	na	na	na	na	nm	nm	nm	nm	nm	6.9
P/BV YE	na	na	na	na	2.80	2.43	neg.	6.26	9.89	4.05
Share price YE (USD)					0.45	0.18	0.21	0.27		

Source: Carnegie Research & company data

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