

TECHNICAL AND COMMERCIAL DILIGENCE

Fantasy Magnets, Inc.

A sintered NdFeB magnet maker, two years in: how ready each step of the process is, who is behind it, and the supply chain underneath it.

Prepared for	Example Capital Partners (also fictional)
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Revision	1.0, including notes from the October 6 follow-up call
Completed	October 9, 2026
Basis	Data room (34 documents), a pilot plant visit, two management calls

In a real engagement this line names the recipient and the confidentiality terms. This one is a public example: Fantasy Magnets does not exist, and nothing in this report describes, or is drawn from, a real company.

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REVISION 1.0 · OCTOBER 9, 2026

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HOW TO READ THIS REPORT

It is built so a reader can stop at any depth. Chapter 1 is the verdict and fits on two pages. Chapter 2 is the list of questions worth asking, each answered in a sentence. Everything after that is the argument, step by step, for anyone who wants to check my reasoning rather than take it.

Notes in the right margin carry the caveats, including the ones that undercut my own numbers; they are worth reading. Readiness is graded on the nine-step technology readiness scale defined in appendix A, never pass/fail, and every grade is shown with its word as well as its color:

TRL 2 · early

TRL 5 · developing

TRL 8 · proven

ABOUT THIS EXAMPLE

Fantasy Magnets is invented. So are its people, its investors, its suppliers, its customers and every figure, table and curve below. Real reports are confidential to the client who commissioned them, and nothing here is drawn from one; this example exists so that someone weighing an engagement can see the shape of the work before paying for it.

The process descriptions stop short of anything a competitor could use (no temperatures, times or field strengths), which is also the rule for anything I publish on the website.

1

Executive summary

An excellent powder company with a mine-to-magnet business plan.

SHORT VERSION

Fantasy Magnets has the best powder line I have seen at a company this young, and very little else in house yet. Technically, it is a strong powder company with a plan written for an integrated oxide-to-magnet business; the distance between the two is three process steps (electrolysis, strip casting and machining) that nobody on the team has done, and a supply chain with more single points of failure than the plan acknowledges.

In a little over two years, Fantasy Magnets has built a pilot line for the powder steps (hydrogen decrepitation, jet milling and pressing in an aligning field) whose results would be respectable at an established producer, and are remarkable at a company of this age.

The credit belongs mostly to one person. The chief technology officer, Dr. Theo Kestrel, has a command of the powder steps that is genuine, deep and visible everywhere in the data; his oxygen control in particular is better than most production lines manage. The founders around him are capable, raise money well, and (unusually) know what they do not know about manufacturing. The financial model is coherent, and the investor materials are honest about stage. ¹

The difficulty is that the plan is written as though the rest of the chain will mature at the rate the powder line did, and the evidence in the data room says otherwise. Electrolysis is a bench experiment. Strip casting has produced flake that the powder line cannot fully redeem, and the magnets made from it show it. Machining, which sets yield and therefore much of the unit cost, has not started, and the plan assumes a yield I would not expect anyone to reach on this part mix in the first two years. None of these is fatal. All three are the parts of the process the current team has never done, which is the pattern worth noticing.

¹ Honest about stage, not about difficulty. The deck describes electrolysis, strip casting and machining as "in development" alongside steps that are genuinely developed, which is accurate in each word and misleading in sum.

4 of 11

Process steps at or near production readiness

TRL 2

Lowest-rated step: machining, which sets yield

62%

Share of 2029 planned volume resting on one customer's letter of intent

~10 qtrs

Heavy rare earth runway at plan, against a second source no earlier than late 2029

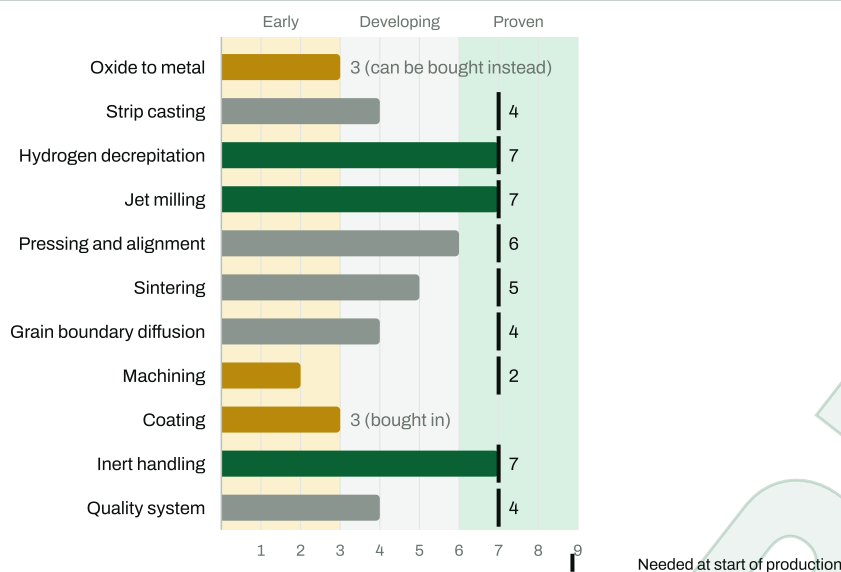


Figure 1. Technology readiness by process step, against the level each step needs by the planned start of production. The four proven steps are the powder steps and the handling between them.

My assessment, from the data room, the pilot plant visit and two calls. The scale is defined in appendix A.

What is genuinely good

- **The powder line.** Particle size distributions narrower than typical production, and oxygen pickup through the powder steps roughly half that of a typical pilot line (chapter 4). This is the hardest-won know-how in the process to buy, and they have it.
- **Magnets from good alloy are good magnets.** Samples made from purchased flake are close to the target grade with good squareness. The powder line is not the bottleneck on quality, which is exactly what one wants to know.
- **The founders.** Disciplined with money, candid in conversation, and quick to accept a criticism and ask what it would take to fix. That last trait will matter more than any piece of equipment.

Where the risk sits

- **The three steps nobody on the team has done:** electrolysis, strip casting and machining. The plan brings all three in house by 2028.
- **The unit cost depends on a machining yield** of 88%, against roughly 65–72% I would expect on this part mix in the first years. That gap alone moves the 2029 gross margin from the plan's 35% to the mid-single digits (chapter 7).
- **Supply:** one oxide supplier on a letter of intent, an interim metal and alloy supply that crosses a border under export licensing, and a heavy rare earth stockpile that runs out before any second source could plausibly exist (chapter 8).
- **Key person:** almost everything that is proven here lives in one head.

The three gaps that matter most

① Strip casting.

Nobody on the team has run a production caster, and the flake still varies from campaign to campaign. What would close it: a casting lead with production experience, then three consecutive campaigns inside the flake specification on their own caster.

② Machining.

Not started, and the unit cost rests on an assumed yield. What would close it: a pilot cell running the lead customer's part, with yield measured rather than assumed, before the machining hall is ordered.

③ Supply.

One oxide source on a letter of intent and a heavy rare earth stockpile with an end date. What would close it: oxide under contract with volumes, a second source, and a plan for heavy rare earths beyond the stockpile.

With those three gaps closed, the plan would rest on demonstrated results rather than assumed ones, and would look like a credible, if slower, version of itself. As it stands, the parts of the plan that carry the most weight are the parts the company knows least. Electrolysis is left off this list deliberately: it is the least ready step, but metal can be bought, so it is the least consequential of the gaps.

2

Key questions

Each answered in a sentence here and argued in the chapter named after it.

Execution

① Can the team that built the powder line build the rest of the plant?

Not as currently staffed. The powder steps are one person's expertise; electrolysis, strip casting and machining are nobody's yet. Three hires close most of the gap (chapters 3 and 9).

② Is the start of production in the third quarter of 2028 achievable?

For a plant that buys alloy flake and machines with a small, well-run cell, yes, with little margin. For the integrated plant in the plan, no; I would put it eighteen months later.

③ Is the machining yield in the model realistic?

No. The model assumes 88% of sintered block mass ends up as finished parts; for thin arc segments in the first two years I would plan on 65–72% (chapter 4.8).

④ Are the equipment choices sound?

Mostly. The powder line equipment is well chosen and well integrated. The sintering furnaces come from a single vendor with long lead times and no spares stocked in country, which is a schedule risk more than a technical one.

⑤ What happens if the CTO leaves?

Today, most of the proven know-how leaves with him. This is the single most important thing to fix that costs almost nothing: document, hire under him, and retain.

Technology

① Can they make magnets that customers will buy?

From purchased flake, yes: close to grade, with good squareness. From their own flake, not yet, and the reason is the flake, not the powder line (chapter 5).

② Does the in-house electrolysis add value?

Not for at least three years. It is at bench scale, the metal can be bought, and the scale-up is a separate company's worth of work (chapter 4.1).

③ Is the claimed intellectual property defensible?

The valuable part is know-how, not patents: the oxygen discipline across the powder line. Of the five filed or claimed inventions, one is credible and

valuable, two are plausible, and two are premature (chapter 6).

Commercial

① Does the unit cost support the assumed price?

At the plan's yields, comfortably; at realistic yields, barely, and not at all if oxide prices rise by a fifth (chapter 7).

② How concentrated is the demand?

Very. One automotive supplier's letter of intent is 62% of 2029 volume, and a letter of intent is not a purchase order.

Supply chain

① Where does the oxide come from, and how firmly?

One separator, under a letter of intent with no volume commitment on either side (chapter 8).

② What about dysprosium and terbium?

A stockpile bought on the spot market, which lasts about ten quarters at plan, against a second source that does not exist yet.

③ Which inputs cross a border that could close?

Interim metal and interim alloy flake, both from overseas toll processors, and both under export licensing that has been tightened before.

3

The company and the team

Smart founders, one very good scientist, and three empty chairs.

At a glance

Founded	2023, as a spinout of the CTO's university powder metallurgy group
Funding to date	\$42M across seed and Series A
Raising	\$120M Series B, in three tranches, for a 1,500 t/yr plant
People	31, of whom 9 are engineers or scientists
Facility	A leased pilot building of about 38,000 sq ft; plant site under option
Pilot capacity	About 25 t/yr of pressed and sintered block, from purchased or own flake
Planned start of production	Third quarter of 2028

The founders

The chief executive, Dana Whitfield, came from growth equity and has run the company's fundraising, its customer development and its finances with a discipline that shows in the data room (which was, for once, complete and organized). The chief operating officer, Marcus Bell, previously built and ran a battery-materials pilot plant; he understands construction, permitting and the reality that plants are late, and he has planned the building accordingly. Neither claims to be a magnet person, and both were quick to agree, when pressed, that the plan's integration timeline was set by the fundraising calendar rather than by the process.²

The one scientist

The technical story of this company is the story of Dr. Theo Kestrel, a powder metallurgist who spent a decade on fine-powder handling before founding the company. His understanding of how a powder behaves (how it picks up oxygen, how its size distribution sets the packing and the alignment, how a few minutes of carelessness between two machines can undo a day of careful milling) is deep and practical, and it is the reason the powder line works as well as it does. He designed the inert transfer system between the decrepitation vessel, the mill and the presses himself, and it is better than what I have seen at plants many times this size.

While that is a real asset, it is also the shape of the problem. He is one person, his expertise ends roughly where the powder begins and ends, and the company has (understandably) built itself around what he knows. The steps on

² To their credit, this was said without defensiveness and with a follow-up question about what a realistic timeline would look like. One hallmark of overly ambitious founders is treating every criticism as a negotiation; these two treated it as information.

either side of the powder line, making the metal and casting the alloy upstream, sintering, diffusing and machining downstream, are treated in the plan as if they were variations on the same skill. They are not. Having spent a career reducing oxides to metal, casting it into alloy, pulverizing, pressing, sintering, grinding, gluing and testing magnets, I would say the steps are about as alike as the instruments in an orchestra: the same building, the same audience, entirely different hands.

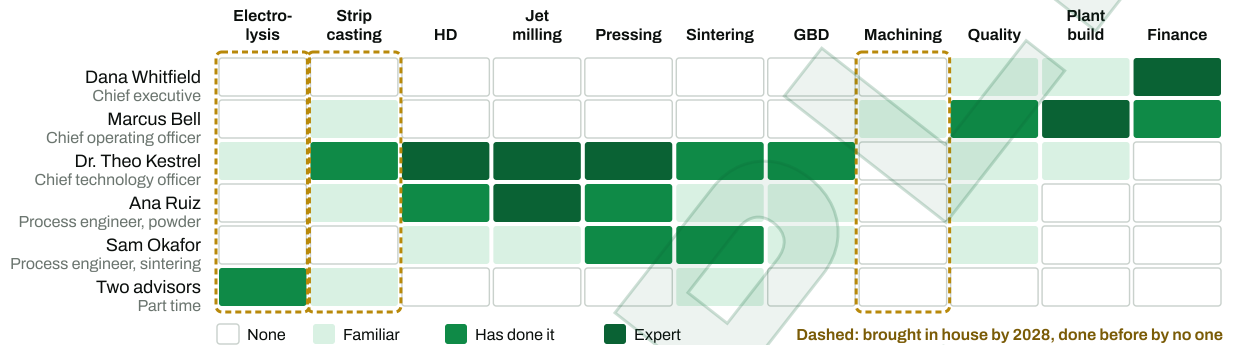


Figure 2. Who has done what. Each cell is my reading of a person's direct experience with a step, from résumés and from the calls, not their title or their interest in it. The powder steps are well covered; the three dashed columns are the steps the plan brings in house with nobody who has done them at scale.

HD is hydrogen decrepitation; GBD is grain boundary diffusion. The advisors are an academic electrochemist and a retired casting engineer, each a few days a month.

RISK: KEY PERSON

If Dr. Kestrel left tomorrow, the company would keep its equipment and lose most of its ability to run it well. Nothing about this is unusual for a company of this age, and nothing about it is expensive to fix: written procedures for the powder line (there are fewer than I would like), a deputy hired under him, and a retention arrangement that vests with the plant, not with the calendar.

The hires that matter

The plan budgets for forty-odd hires by the start of production, almost all of them operators and technicians. The three that matter are senior, and only one of them is in the plan at all: a strip casting lead who has run a production caster; a machining manager who has run a grinding and slicing hall for magnets or for a similarly brittle material (ceramics and carbide both teach the right habits); and, later and only if electrolysis is pursued, an electrochemical engineer who has run cells at production scale. Chapter 9 sets out when each needs to be in seat.

4

Process review, step by step

Ten steps from oxide to finished part, graded for readiness, in the order the material sees them.

The process below is the conventional route for sintered neodymium-iron-boron magnets, and Fantasy Magnets is right not to reinvent it.³ What matters is which steps they do themselves, which they buy, and how far along each one is.

Figure 3 is the map; the sections after it take each step in turn.

³ Credit where due. One hallmark of overly ambitious "academic" entrepreneurs is the desire to reinvent every wheel at once; this team reinvented one (the handling between the powder steps) and bought the rest off the shelf, which is the right instinct.

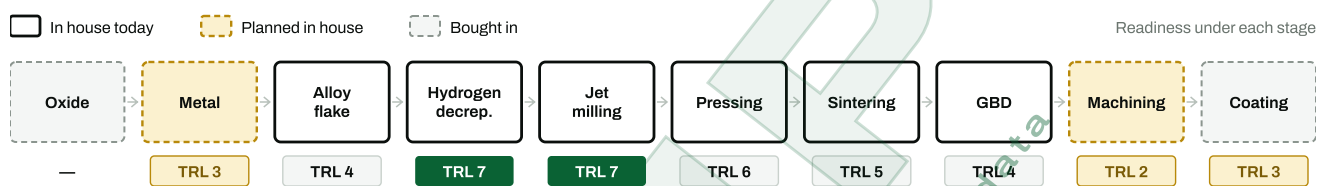


Figure 3. The process chain as Fantasy Magnets runs it today. Metal is bought from a toll converter while the company develops its own cell; alloy flake is partly bought and partly cast on a small pilot caster; machining has not started. GBD is grain boundary diffusion. Oxide is bought and not graded.

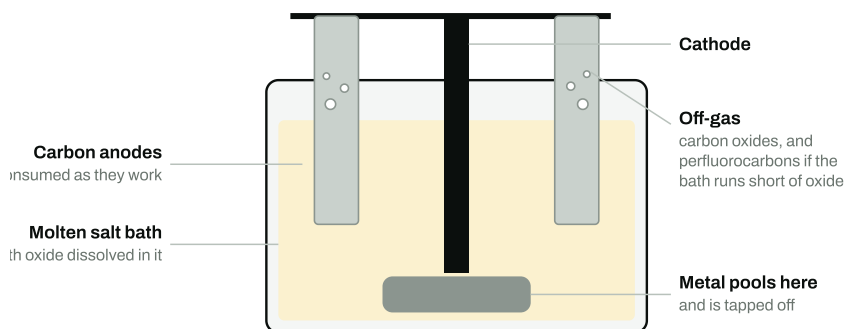
4.1 Oxide to metal: molten salt electrolysis

TRL 3 · early

A working bench cell and a good literature review. A reasonable proof of concept, and a long way from a production step.

Rare earth metal is made by dissolving oxide in a molten fluoride salt and passing a large current through it: carbon anodes are consumed, metal collects at the cathode and pools below it, and the off-gas is mostly carbon oxides. When the bath runs short of dissolved oxide the cell can start producing perfluorocarbons, which are potent greenhouse gases, and controlling that is a large part of running a cell well.⁴

⁴ The general mechanism is textbook. What is not textbook, and not discussed in the data room, is how one keeps a cell running within its window for weeks rather than hours, which is where the real difficulty lives.



Fantasy Magnets has run one bench cell of this kind. A 1,500 t/yr magnet plant needs dozens, each much larger.

Figure 4. A molten salt electrolysis cell, schematically. The physics scales; the control problem does not scale gracefully, and it is the control problem that decides whether the metal is in specification.

Illustration, not to scale, and not Fantasy Magnets' cell design.

Fantasy Magnets has run one bench cell for a cumulative few dozen hours, in runs of a shift or less, and produced a few kilograms of metal. The data room discusses current density and cell voltage in detail. It does not discuss bath chemistry control, the pickup of carbon and of transition metals from the cell hardware, sludge (undissolved oxide settling into the metal), or any run long enough for those problems to show up, and that absence is the finding. Every one of those is a problem that appears only at scale and only with time.

Some arithmetic of my own makes the scale plain. A plant shipping 1,200 t of finished magnets a year, at realistic machining yields, sinters roughly 1,700 t of block, which contains on the order of 500 t of rare earth metal.⁵ The bench cell's total output to date is about one hundred-thousandth of one year's need.

⁵ My arithmetic, rounded, and deliberately conservative on machining yield (see 4.8). At the plan's own 88% yield the figure falls to about 400 t; the conclusion does not change.

NOTES FROM THE CALL, SEPTEMBER 29

Fantasy Magnets considers electrolysis strategic because it decouples them from overseas metal converters. That is a fair goal, and one I share. Asked who would lead the scale-up, they named their electrochemistry advisor (part time, academic). Asked about long-duration runs, they said these are planned for the second half of 2027.

RISK

Electrolysis is on the plan's critical path when it does not need to be. A metal shortfall stops the plant; a slow electrolysis program stops nothing if the metal is bought. Treated as research, with metal bought under contract, it stops being a schedule risk. The plan's capex includes the first twelve production cells.

4.2 Alloy: strip casting

TRL 4 · developing

A pilot caster that works, and flake that varies from campaign to campaign in ways the powder line cannot fix.

In strip casting, the alloy is melted and poured through a tundish onto a water-cooled spinning wheel, which freezes it into thin flakes in a fraction of a second. Everything downstream depends on what happens in that fraction of a second: fine, evenly spaced grains with the neodymium-rich phase between them make a good magnet; coarse grains, or dendrites of free iron where the melt cooled too slowly, make a worse one, and no amount of care in the powder steps afterward will make it good.⁶

⁶ An everyday analogy, offered with apologies to metallurgists: one cannot fix an underbaked cake by slicing it more neatly.

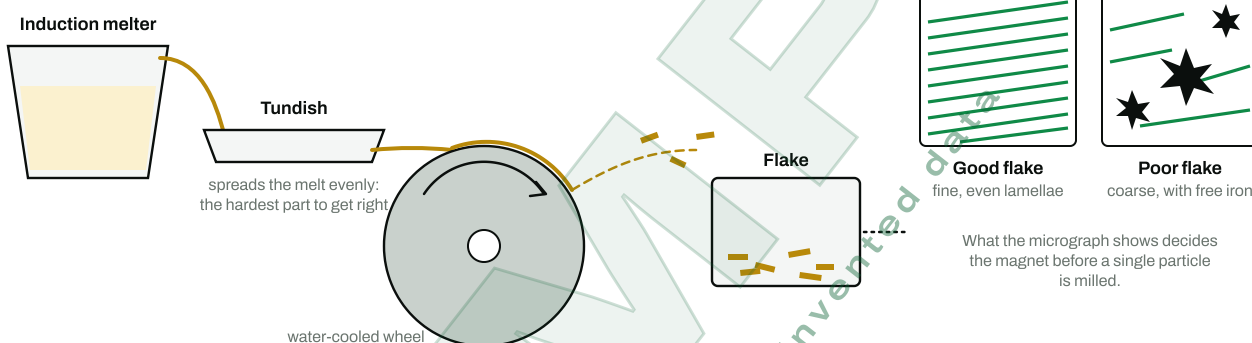


Figure 5. Strip casting, schematically, with the two flake structures that matter. Free iron (the dark dendrites) forms where the melt cools too slowly, and it shows up in the finished magnet as a demagnetization curve that sags from the start. Illustration, not to scale; microstructures drawn, not photographed.

Fantasy Magnets bought a small vacuum induction melter with a wheel caster in 2025 and has run fourteen casting campaigns on it. The team learned a great deal, and it shows: the early campaigns were poor, the recent ones are better. But the flake still varies from campaign to campaign in ways the powder line cannot correct, and the magnets made from it show the variation directly (Figure 6). The magnets made from purchased flake, through the same powder line, do not.

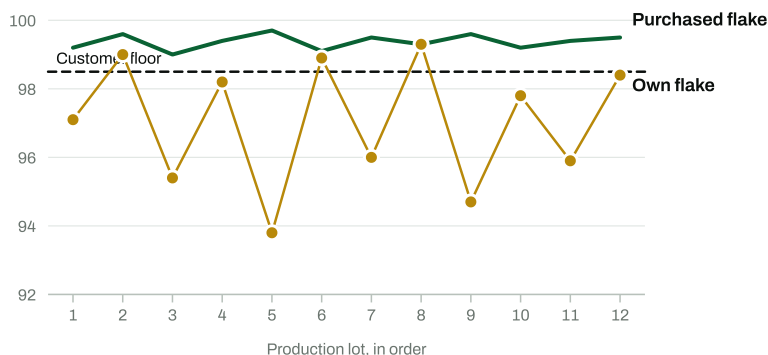


Figure 6. Remanence of the last twelve pilot lots made from each source of flake, indexed to the target grade's typical value (100). Same powder line, same presses, same furnace: the difference is the flake.

Pilot line lot records in the data room; indexing mine. Invented data.

Two things are true at once. The pilot caster is a reasonable learning tool, and casting is learnable: the process parameters move from pilot to production scale better than most, and good production casters are bought, not invented. But nobody on the team has run one in production, the tundish design (which is where most casting problems live) has been changed four times in fourteen campaigns, and the plan has the company casting all of its own flake by mid-2028. I would not plan on that without a person in seat who has done it.

NOTES FROM THE CALL, SEPTEMBER 29

The team is aware of the free-iron problem and attributes it to wheel speed and the tundish. I agree with the diagnosis. They asked whether a larger caster would make the problem easier; in my experience it makes some problems easier and others new.

4.3 Hydrogen decrepitation

TRL 7 · proven

Production-appropriate equipment, run often, with real process control. Nothing to add but credit.

Flake absorbs hydrogen, swells and cracks into a coarse powder; the hydrogen is then driven back out. The equipment is well understood and Fantasy Magnets bought it from an experienced vendor. What sets them apart is not the vessel but what happens at its outlet, which is the start of the inert handling system described under 4.4. Batch-to-batch consistency in the run logs is excellent, and the statistical process control is real (charts that are read and acted on, rather than charts that are printed for visitors).

4.4 Jet milling, and the handling around it

TRL 7 · proven

The company's strongest work, and one of the best powder lines I have seen at any scale.

The coarse powder is milled in a stream of inert gas until it is a few microns across and then classified, so that the fines and the oversize are both removed. Two things matter: how narrow the size distribution is, and how little oxygen the powder picks up on the way. Milled powder is self-heating in air, and every brief exposure costs magnetic performance, so a mill's real quality is measured at its outlet, not its inlet.⁷

⁷ Most magnet makers find that the jet mill and the transfers either side of it are where most of the unwanted oxygen gets in. That makes this step quietly decisive for the whole plant.

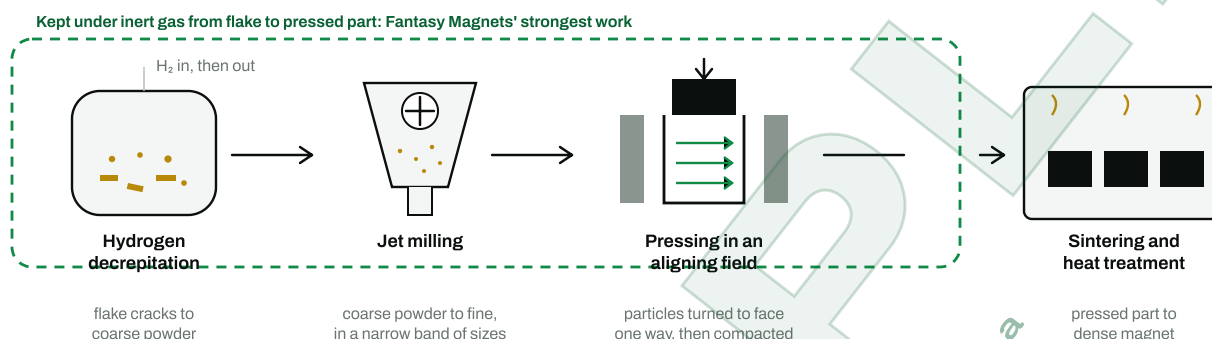


Figure 7. The powder line, schematically. The dashed envelope is the part Fantasy Magnets designed itself: powder never meets air between the decrepitation vessel and the press.

Illustration, not to scale, and not their equipment layout.

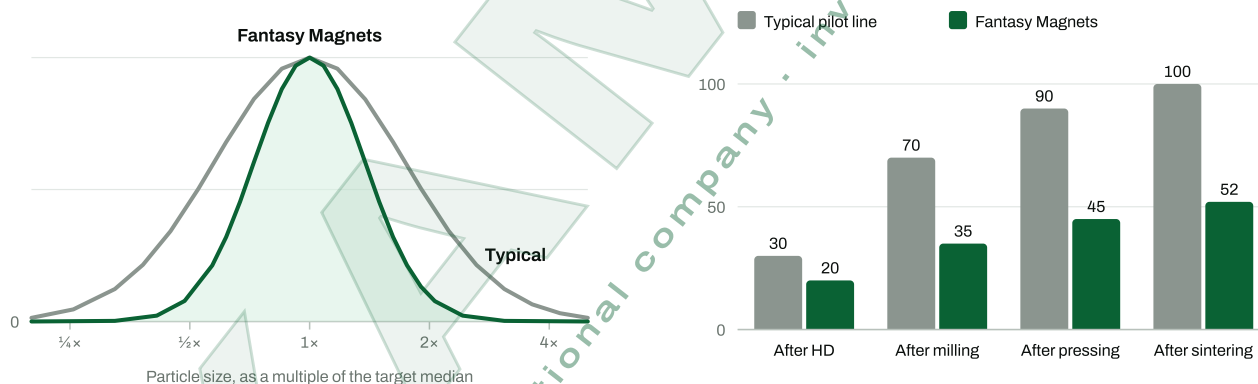


Figure 9. Oxygen picked up through the process, cumulative, indexed to a typical pilot line's sintered block (100). Less oxygen means more of the rare earth does magnetic work.

Company data; the typical line is my estimate. Invented data.

On both measures Fantasy Magnets is very good. The distribution is markedly narrower than typical, and oxygen pickup is roughly half that of a typical pilot line at every stage. Both results come from the same source: an inert handling system that keeps powder out of air from the outlet of the decrepitation vessel to the closed die of the press, with oxygen monitored at every transfer and an interlock that stops a transfer rather than letting a bad one through. It is simple, robust and well engineered, and (in the right sense of the word) boring.

IN FAIRNESS

It would be easy to read the rest of this report as a list of shortcomings and miss the point of this section. The powder steps are the part of magnet making that is hardest to buy and slowest to learn, and the part where an experienced competitor's advantage is most durable. Fantasy Magnets has that advantage already. Everything else in this report is about the steps on either side of it.

4.5 Pressing and alignment

TRL 6 · developing

Good alignment on pilot presses; the production presses are not yet chosen.

The milled powder is poured into a die, the particles are turned to face one direction by an applied field, and the powder is pressed. The quality of that alignment sets how much of the material's potential remanence is realized. Fantasy Magnets measures it properly and achieves good results on two pilot presses. The production presses are still out for quotation, and the integration of the inert powder feed (their strength) with a vendor's press and automation (not yet their strength) is where I would expect the first surprises. The grade is TRL 6 rather than 7 for that reason, not for any fault in what has been done.

4.6 Sintering and heat treatment

TRL 5 · developing

One grade's recipe developed; the second and third not yet. The furnace vendor is a schedule risk.

Sintering densifies the pressed part, and the heat treatments that follow develop the structure between the grains that gives the magnet its coercivity. It is second only to the alloy chemistry in deciding performance, and it cannot be reverse-engineered from a magnet bought on the open market: each recipe is a function of a particular chemistry and particle size, and each iteration takes a furnace cycle and a measurement. Fantasy Magnets has developed a reliable recipe for its first target grade and has started on a higher-coercivity grade. The plan needs three grades at the start of production.

The production furnaces are specified from a single vendor with long lead times and no spares or service engineers in country. The vendor's equipment is good; the arrangement is fragile. Chapter 8 counts this among the supply exposures.

4.7 Grain boundary diffusion

TRL 4 · developing

Demonstrated on coupons in the lab; not yet on production geometry, and the intellectual property is not cleared.

Diffusing dysprosium or terbium in from the surface of a finished block puts the heavy rare earth where it does the most good, at the grain boundaries, and achieves a given coercivity with a fraction of the heavy rare earth that alloying it

in would need (appendix A has a short primer). It is essential for the high-temperature grades the lead customer wants. Fantasy Magnets has shown it works on small coupons; it has not shown it on the thickness and shape of the customer's part, where diffusion depth becomes the limit, and it has not completed a freedom-to-operate review in what is the most crowded patent landscape in the process.⁸

⁸ I am not a patent attorney, and nothing here is a legal opinion. The point is that a review by one is needed and has not been done.

4.8 Machining

TRL 2 · early

Not started. The equipment is the easy part; the yield is not, and the plan's yield assumption carries the business model.

Sintered blocks are sliced and ground to the customer's shape. The equipment is off the shelf, and machining is the step that new magnet companies most often treat as the easy part, which is fair as far as the machines go. But sintered magnets are brittle, the customer's parts are thin arc segments, and every cut costs a kerf; the share of the sintered block that becomes a finished, in-specification part (the machining yield) decides how much of every expensive kilogram upstream gets sold. Thin parts and small parts machine worse, because they have more surface per kilogram.

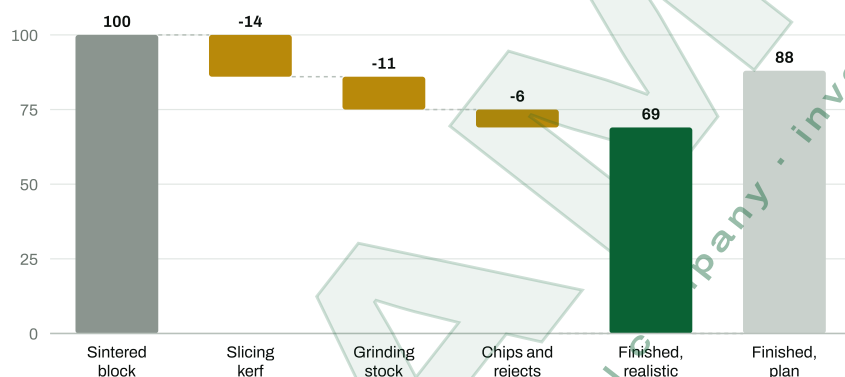


Figure 10. Where 100 kg of sintered block goes on the way to the lead customer's part, at a realistic first-years yield, against the plan's assumption.

My estimate for this part family; the plan's figure is from its cost model. Invented data.

The plan assumes 88%. For this part family in the first two years I would expect 65–72%, improving toward the high seventies with fixture work and part redesign negotiated with the customer.⁹ Nobody on the team has run a machining hall, no machining lead is in the hiring plan, and the cost model does not have a line for grinding consumables. Each of these is fixable; together they explain the TRL 2.

⁹ This range is drawn from experience with similar part families, not from Fantasy's parts, which have not yet been cut. It could be wrong in either direction, and the pilot cell recommended in chapter 9 exists precisely to replace my number with theirs.

RISK

Machining yield is the single assumption in the model that moves the margin most (chapter 7). It is also the cheapest of the gaps to test: a two-machine pilot cell running the lead customer's actual part would produce a measured yield within six months of being ordered.

4.9 Coating

TRL 3 · early

Bought in, sensibly. Two quotes, no qualified supplier.

Neodymium magnets corrode, and the lead customer's part needs an epoxy coating. Fantasy Magnets intends to use a contract coater, which is the right choice at this scale. Two coaters have quoted; neither has coated the company's parts, and coating adhesion depends on how the part was machined and cleaned, which nobody can test until machining exists.

4.10 Inert handling and the quality system

TRL 7 · proven (handling)

TRL 4 · developing (quality)

The handling is excellent. The quality system is a good start that the lead customer will not yet accept.

The handling is covered under 4.4. The quality management system is working toward ISO 9001 and is well organized for a pilot line. The lead customer requires IATF 16949, the automotive standard, which is a substantial step up in documentation, supplier control and traceability, and typically takes a year or more from a standing start to certification. It is not in the schedule.

Summary of the process review

Step	Today	Readiness	Needed at start of production	What closes the gap
Oxide to metal	Bench cell	TRL 3	Nothing, if metal is bought	Buy metal; fund as research
Strip casting	Pilot caster, variable flake	TRL 4	TRL 7, or purchased flake	Hire a casting lead; buy flake meanwhile
Decrepitation, milling	Excellent	TRL 7	TRL 7	Document it; hire a deputy
Pressing	Good, on pilot presses	TRL 6	TRL 7	Production press integration
Sintering	One grade of three	TRL 5	TRL 7, three grades	Recipe development; furnace spares
Diffusion	Coupons only	TRL 4	TRL 7 on the customer's part	Trials on real geometry; patent review
Machining	Not started	TRL 2	TRL 7, at a known yield	Hire a lead; pilot cell on the real part
Coating	Two quotes	TRL 3	A qualified coater	Qualify once machined parts exist
Quality system	Toward ISO 9001	TRL 4	IATF 16949	Start now; it takes a year

5

Magnetic data

From good flake, close to grade. From their own flake, not yet.

The data room holds measurements on five sample sets, all taken on the company's own hysteresisgraph, and two of them repeated by an independent laboratory, which agreed with the company's figures within normal measurement scatter.¹⁰ The values below are indexed to the target grade's typical datasheet values, so that 100 means "what a customer would expect".

¹⁰ That agreement matters more than it sounds. A company measuring its own magnets on its own instrument is a reasonable first check and a poor last one; having two sets repeated independently is the reason I treat the remaining three as credible.

Sample set	Flake	Target grade	Remanence	Coercivity	Squareness	Verdict
FM-0218	Own, campaign 6	Grade 1	96	88	0.82	Not sellable
FM-0305	Purchased	Grade 1	99	97	0.95	Sellable, low in band
FM-0412	Own, campaign 11	Grade 1	98	91	0.86	Marginal
FM-0509	Purchased	Grade 2	99	94	0.93	Close; recipe still in development
FM-0611	Purchased	Grade 1	100	99	0.96	Sellable

Squareness is the ratio of the field at which the curve has fallen to 90% of its remanence to the intrinsic coercivity; above about 0.9 is what motor designers expect. Values indexed to the target grade = 100. Invented data.

The pattern is the one chapter 4 predicts. The powder line, the presses and the furnace are capable of making the target grade: the purchased-flake samples are in or near specification and their squareness is good. The own-flake samples are low on coercivity and poor on squareness, and the shape of the curve (Figure 11) says why.

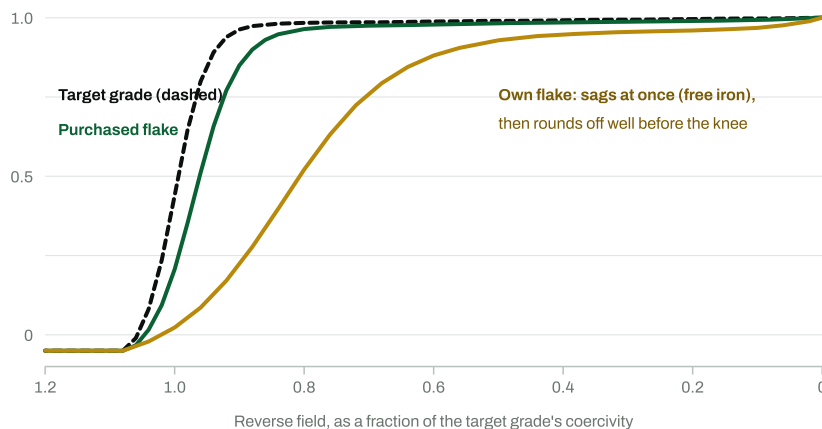


Figure 11. Second-quadrant intrinsic demagnetization curves, normalized to the target grade. A good magnet holds its magnetization almost flat until a sharp knee; the own-flake sample sags from the start and rounds off well before the knee, which is the signature of free iron and coarse grains in the flake.

Company hysteresisgraph data, normalized by me. Invented data.

The immediate drop from the vertical axis is the signature of free iron, which is a casting problem; the rounded shoulder that follows reflects a coarser, less even microstructure, which is also mostly a casting problem here, since the same furnace produces square curves from purchased flake. In short, these are good magnets made from imperfect alloy, which is a much better problem to have than the reverse.

FURTHER NOTES FROM THE OCTOBER 6 FOLLOW-UP CALL

Fantasy Magnets shared results from casting campaigns 13 and 14, run after a tundish redesign. Magnets from that flake index 99 on remanence and 95 on coercivity with squareness of 0.91: sellable, low in the band. This is a genuinely encouraging step, and it moves strip casting from the bottom of TRL 4 toward the top of it. Questioning made clear that the improvement was found rather than designed (the team changed three things at once and cannot yet say which one mattered), so I have left the grade where it was. Two good campaigns are a result; three consecutive good campaigns, after a deliberate change, would be a process.

6

Claimed intellectual property

The valuable part is know-how, and know-how does not appear in a patent list.

Fantasy Magnets lists five inventions in the investor materials, two of them filed as provisional patent applications. I have assessed each for whether it is technically credible and whether it would matter commercially if it were. This is a technical reading, not a legal one.

Claim	Assessment	Verdict
Closed-loop oxygen control across the powder line	Credible and demonstrated; the results in chapter 4 are the evidence. The value lies in the integration and the discipline, much of which is know-how a patent would disclose rather than protect. I would keep most of it as a trade secret.	Credible, valuable
Mixed-gas jet milling for a narrower size distribution	Plausible, and consistent with the data. Whether the narrowness comes from the gas or from the classifier settings is not separable from what was shared.	Plausible
Single-step diffusion by co-pressing a heavy rare earth layer	Elegant on coupons. On production geometry, the heavy rare earth will tend to dissolve into the grains during sintering rather than staying at the boundaries, which is the effect diffusion exists to avoid. Possible, not yet shown.	Plausible, unproven
A low-emission electrolysis cell design	The cell has not run long enough to know whether it is low-emission. Promising ideas, bench evidence.	Premature
Machine-learning yield prediction	There is not yet enough production data to train anything on, and magnet making is a badly behaved process in which cause and effect are often separated by days and several steps. Worth doing in three years.	Premature

No freedom-to-operate review has been done for grain boundary diffusion, which is the step where it matters most (4.7). That should be commissioned before the diffusion equipment is ordered.

7

Business and commercial outlook

A coherent model, built on three assumptions that each lean the same way.

The model is well built: clean, traceable and internally consistent, with assumptions labeled as assumptions. My concern is not its construction but three of its inputs (volume ramp, machining yield and capex) which each lean optimistic, and lean the same way, so that their errors compound rather than cancel. The plan also prices every kilogram at a flat \$95/kg through 2030, which I treat here as given and come back to at the end.¹¹

¹¹ All prices and costs in this chapter are invented for the example, and they are deliberately round. They are not a view on any real market price.

The ramp

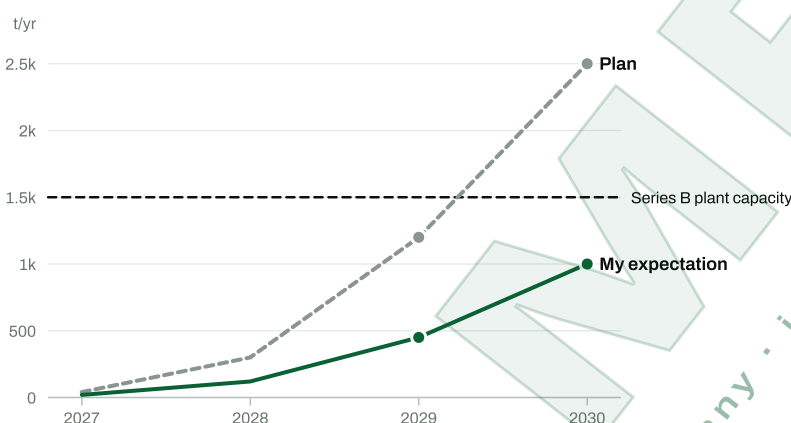


Figure 12. Finished magnet shipments, plan against my expectation. Note that the plan's 2030 volume exceeds the capacity of the plant the Series B pays for, so it quietly assumes a second plant and a further raise.

Plan from the company model; my line assumes purchased flake through 2028, the yields in 4.8, and a lead customer qualifying in 2029 rather than 2028.

The plan reaches 1,200 t in 2029, the second full year of production. I expect closer to 450 t: a plant that starts on time still takes most of two years to reach steady yields, and the lead customer's qualification (part approval, then a production trial, then volume) does not compress just because the plant is ready. The difference is not a criticism of ambition; it is the difference between when the plant could ship and when the customer will buy.

Capital expenditure

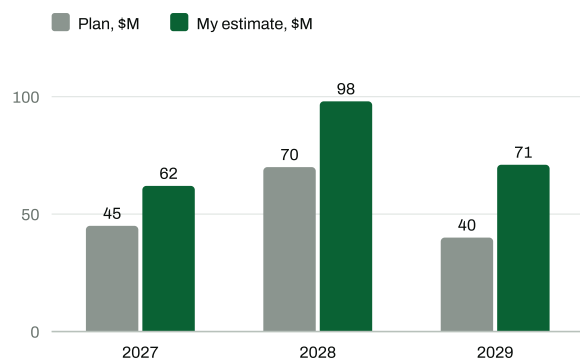


Figure 13. Capex by year: \$155M in the plan, about \$231M in my estimate, for the same plant.

Invented data.

Most of the difference is in four places:

- **Machining** (+\$22M): the plan prices a hall sized for 88% yield. At realistic yields one needs more slicing and grinding capacity per finished kilogram, and the plan has no line for consumables or fixtures.
- **Electrolysis** (+\$18M net): the plan's twelve cells are priced at a figure I could not reconcile with any cell of that size.
- **Building and utilities** (+\$21M): hydrogen storage, argon, power and floor loading are the usual sources of surprise, and the plan carries a 5% contingency where 15% is customary at this stage of design.
- **Spares and commissioning** (+\$15M): two years of critical spares for single-source furnaces, and a realistic commissioning period.

If electrolysis is deferred, as chapter 9 recommends, my estimate falls to about \$190M. Either figure is well above both the plan's \$155M and the \$120M being raised, which is worth knowing before the plant is sized.

Unit cost and margin

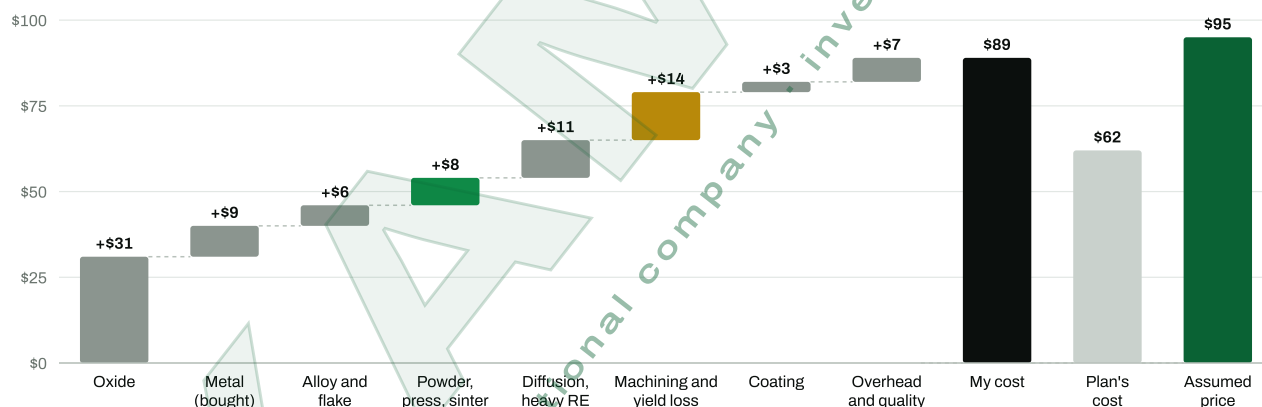


Figure 14. Cost per kilogram of finished magnet at 1,200 t/yr, built up step by step, against the plan's cost and the assumed selling price. The powder steps (green) are a small and well-controlled share; machining and yield loss (amber) is where the plan and I part company.

My build-up from the company model, adjusted for the yields in 4.8 and bought metal. Invented data.

The plan's \$62/kg rests on 88% machining yield and on in-house metal at a conversion cost the bench cell has not demonstrated. With realistic yields and bought metal I arrive at \$89/kg, which leaves a gross margin of about 6% at the assumed price, against the plan's 35%.¹² That is thin but not hopeless; it improves with every point of machining yield (each point is worth about \$1.30/kg), and it is roughly where established producers sit in a weak year. What it is not is the business in the deck.

¹² A wider point that one should not lose: almost a third of the cost of a finished magnet is oxide, which nobody in this business controls. A company whose margin depends on the oxide price staying put has a commodity exposure, whatever its technology.

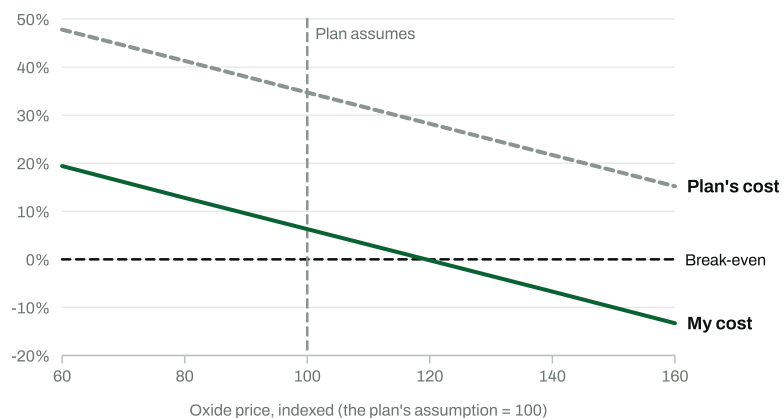


Figure 15. Gross margin at the assumed \$95/kg price as the oxide price moves. On my cost basis, a rise of about a fifth in oxide takes the business to break-even.

My calculation. Invented data.

Customers

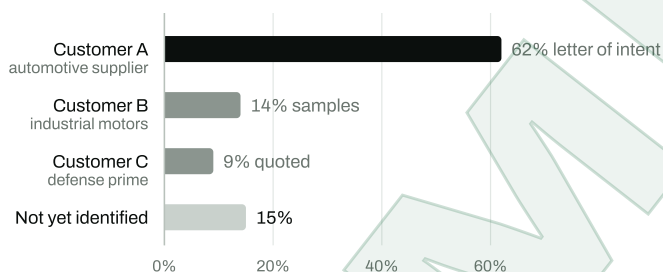


Figure 16. Planned 2029 volume by customer and the status of each relationship.

Company pipeline, my classification. Customer names withheld in a real report too.

Customer A's letter of intent is a serious document from a serious company, and the engineering relationship behind it is real. It is also non-binding, carries no volume or price commitment, and is conditional on part approval that requires the automotive quality certification described in 4.10. A business with 62% of its volume on one letter of intent has a single point of failure on the demand side to match the ones on the supply side.

The price

The plan holds \$95/kg flat through 2030. That is defensible for a buyer who values a non-Chinese supply chain and has signed for one, and optimistic as a market-wide assumption for a commodity whose price has moved by more than half in either direction within a year more than once. It would be prudent to model a price band rather than a price, and to seek the floor-and-ceiling pricing (or an oxide pass-through) in the Customer A contract that would make the band survivable.

8

Supply chain exposures

Most of the risk in this business sits upstream of anything the company makes.

A magnet plant is the narrow end of a long funnel, and Fantasy Magnets has (sensibly, at this stage) bought most of what flows into it rather than making it. That makes the supply chain the place where the company is most exposed and has least control. Figure 17 maps every input that would stop the plant if it stopped arriving; the table that follows grades each.

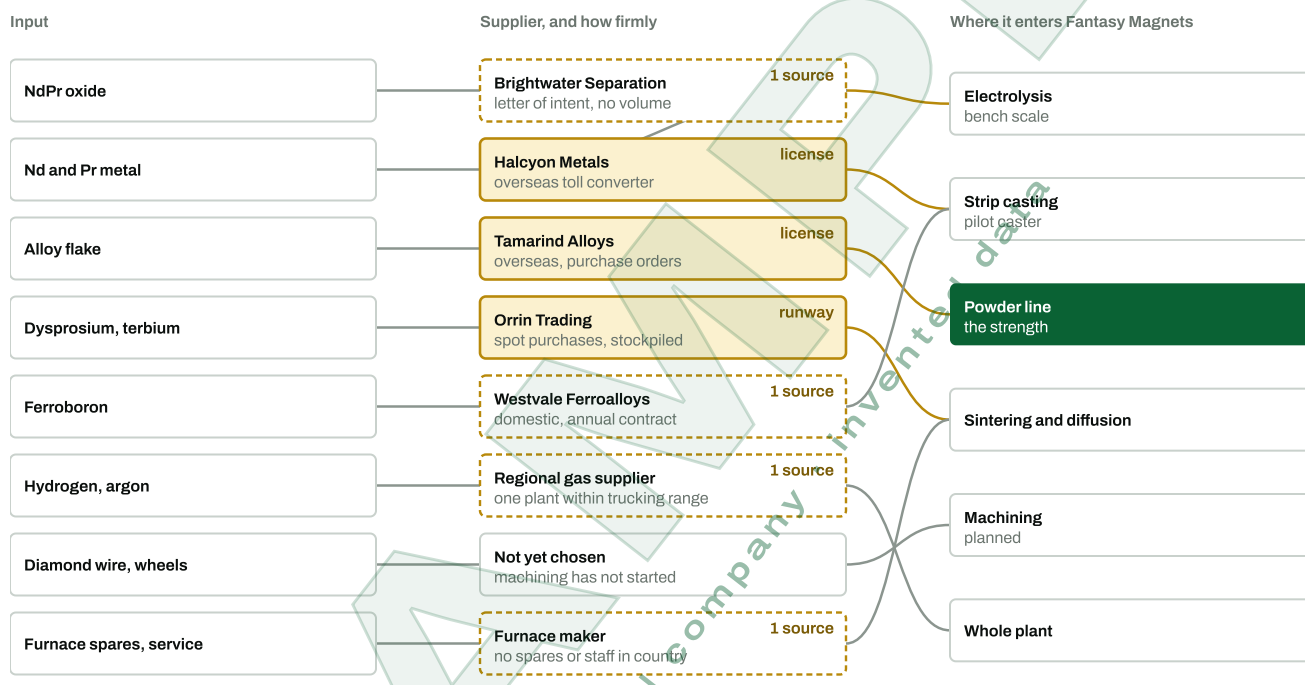


Figure 17. What flows into the plant, from whom, and where it enters. Shaded amber: an input that crosses a border under export licensing, or that runs out on a date. Dashed amber: a single source with no contracted alternative. Amber curves carry those exposures into the plant. Data room supply agreements and the calls; the supplier names are as fictional as the company.

Input	Today	What happens if it stops	Exposure
NdPr oxide	One separator; letter of intent, no volume commitment on either side	Everything stops. A letter of intent represents interest, not diligence; the supplier's own expansion, on which the volumes depend, is itself unfunded.	High
Metal (interim)	Overseas toll converter; oxide shipped out, metal shipped back	Casting stops. The route crosses a border under export licensing that has been tightened before, with weeks of notice.	High
Alloy flake (interim)	Overseas caster, purchase orders	The best magnets stop, since today they are made from this flake. Same licensing exposure as the metal.	High
Dysprosium, terbium	Spot purchases, stockpiled	High-temperature grades stop when the stockpile runs out (Figure 18).	High

Input	Today	What happens if it stops	Exposure
Ferroboron	One domestic supplier, annual contract	Casting stops; a second source could be qualified in months, not years.	Moderate
Hydrogen, argon	One regional supplier	Decrepitation and casting stop. On-site storage of a few days is planned; a second supplier would cost more per unit and is worth it.	Moderate
Furnace spares	Single overseas maker, no local stock	A failed furnace waits for a part. Two years of critical spares on site fixes most of this.	Moderate
Machining consumables	Not yet chosen	Several good suppliers exist; this is a cost line missing from the model rather than a supply risk.	Low

The exposure badges reuse the readiness colors in reverse sense: amber is a high exposure, green a low one.

Heavy rare earths

The high-temperature grades the lead customer wants need dysprosium or terbium even with grain boundary diffusion. Fantasy Magnets bought a stockpile on the spot market in 2025 (a sensible move, and one that took some nerve) and has no contract for more. At the plan's ramp the stockpile runs out in the second quarter of 2029. The only second source in view is a heavy rare earth circuit that Brightwater Separation intends to build, which could not plausibly produce before the end of 2029 even if it were funded today, and it is not.

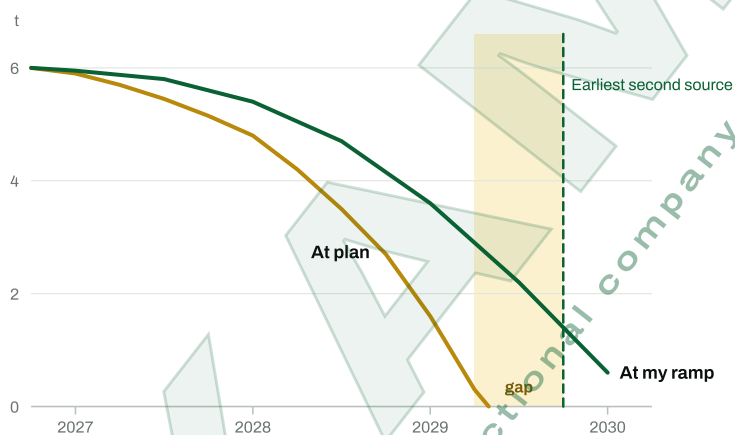


Figure 18. Heavy rare earth stockpile, dysprosium and terbium combined, as it is drawn down. At plan it runs out about two quarters before the earliest second source could exist; at my slower ramp it lasts, but only because the business is smaller.

Company inventory and consumption model; my ramp from chapter 7. Invented data.

There is an irony worth naming: the slower ramp I expect makes this exposure smaller, which is cold comfort. The honest framing is that heavy rare earth supply is a constraint on the whole industry outside China, not a failing of this company, and that what distinguishes companies is whether they have a funded plan. Fantasy Magnets has a good stockpile and no plan.

Equipment

The powder line equipment is from established vendors with local support. The sintering furnaces are not: a single overseas maker, long lead times, and no spares or service staff in country. Nothing about the equipment is poor; what is fragile is the arrangement. I would budget two years of critical spares and send two of the company's own technicians to the maker's factory during the build.

All of the risks in one place

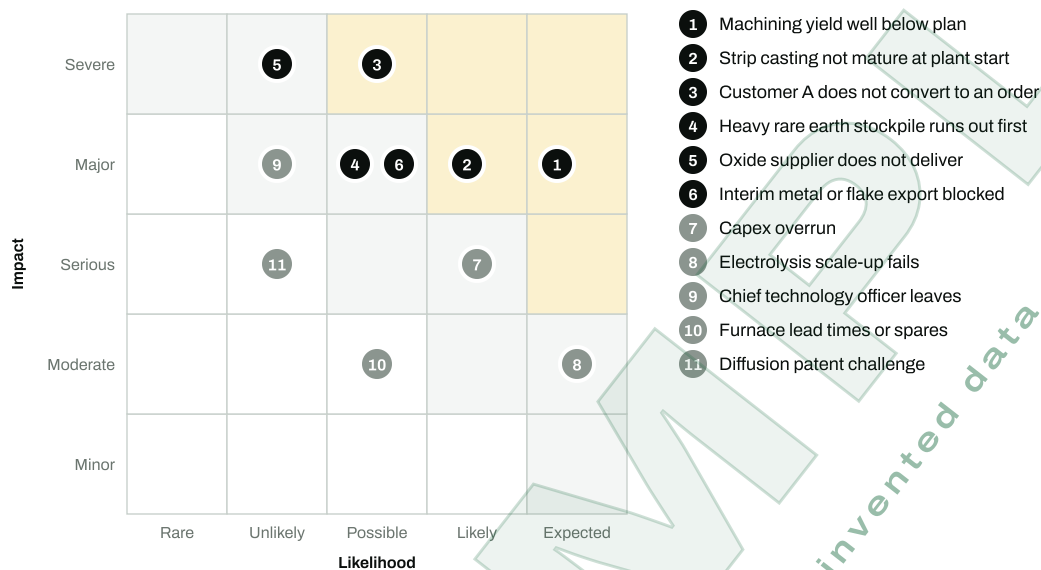


Figure 19. The risks in this report on one page, by my estimate of likelihood and impact. Dark dots are the risks that chapter 1 groups into the three gaps. Electrolysis failing is likely and, if the metal is bought, almost harmless, which is the case for buying it.

My judgment; not a quantified model.

9

Recommendations for risk mitigation

What the company could do to close each gap: buy what it cannot yet make, and hire for what it will.

People

1 A strip casting lead, now.

Someone who has run a production caster, ideally for magnet alloy, failing that for another rapidly solidified alloy.

2 A machining manager, within six months.

Experience running a slicing and grinding hall for magnets or for a similarly brittle material. Before the machining hall is specified.

3 A deputy for the chief technology officer, and the documentation to go with it.

The cheapest risk reduction available.

4 An electrochemical engineer with production cell experience, only if and when electrolysis moves beyond research.

Process

- **Defer electrolysis** to a separately funded research program and buy metal under a contract, not purchase orders.
- **Buy flake through 2028** while casting is matured on the pilot caster under a new lead, with three consecutive in-specification campaigns as the test.
- **Build a two-machine machining pilot cell now**, run the lead customer's part, and put the measured yield in the model.
- **Start the automotive quality certification now**. It takes a year and gates the lead customer.
- **Commission a freedom-to-operate review** for grain boundary diffusion before ordering diffusion equipment.

Supply chain

- **Convert the oxide letter of intent into a contract with volumes**, and open a second oxide relationship, even a small one.
- **Build a heavy rare earth plan**: a larger stockpile, an offtake from a producer already operating, or both.
- **Hold two years of critical furnace spares** on site, and train in-house service technicians at the maker.
- **Seek oxide pass-through or a price collar** in the Customer A contract.

Milestones that would show the gaps closing

The most useful way to track progress is against results that test the three weak steps directly, rather than against calendar dates or headcount. Figure 20 lays three such milestones over the work.

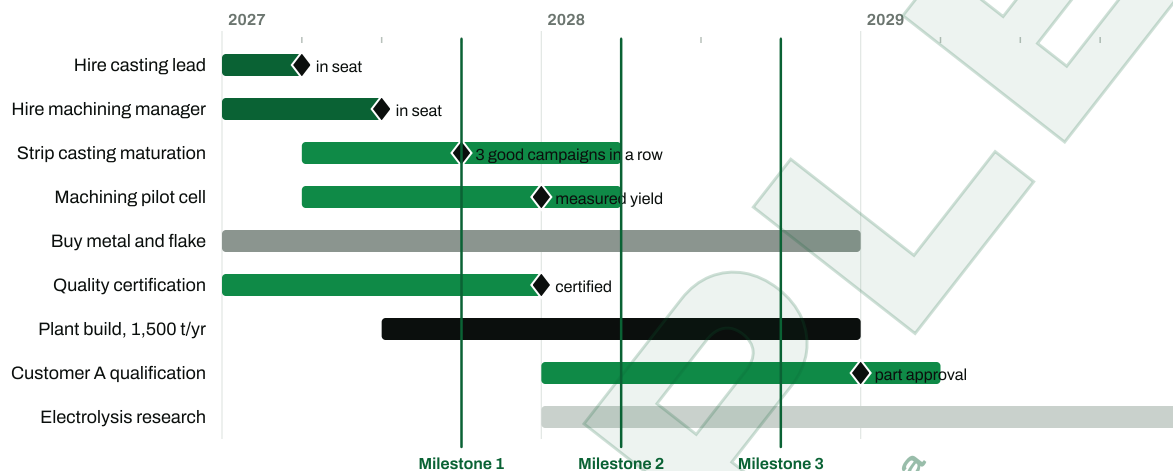


Figure 20. The work, and three milestones that would show the gaps closing. **Milestone 1:** casting lead in seat and three consecutive in-specification campaigns. **Milestone 2:** machining yield measured on the customer's part at 72% or better, and the model rebased on it. **Milestone 3:** oxide under contract with volumes, a heavy rare earth plan beyond the stockpile, and quality certification in hand.

My suggested sequence; dates indicative.

WHAT WOULD CHANGE MY MIND

Upward: a casting lead with production experience already in conversation with the company; a measured machining yield above 75% on the real part; or Customer A converting its letter of intent into a contract with volumes. Any one of these would move my view of the ramp materially.

Downward: a further tundish redesign without a lead in seat; the stockpile drawn down for development work; or the integrated plan pursued unchanged with the capex as budgeted.

Respectfully submitted,

David Maybury

Peculiar Materials LLC · October 9, 2026

A

Readiness scale and two primers

The scale used throughout, and the two pieces of background most worth having.

The readiness scale

Grades in this report use the nine-level technology readiness scale, read for a manufacturing step rather than for a product. A step is graded on what has been demonstrated, not on what is planned or purchased.

Level	Shorthand	What it means for a step in a magnet plant
TRL 1	Principle	The physics or chemistry is understood; nothing has been built.
TRL 2	Concept	A process route and equipment have been chosen on paper.
TRL 3	Proof of concept	The step has been done once, at bench scale, and produced material.
TRL 4	Lab validation	Repeated at bench or pilot scale, but output varies and the causes are not all known.
TRL 5	Pilot validation	Repeatable at pilot scale on representative material, for at least one product.
TRL 6	Pilot, near production	Repeatable at pilot scale across the products needed; production equipment specified.
TRL 7	Production-ready	Production-appropriate equipment, run repeatedly, under statistical process control.
TRL 8	Qualified	Product from the step has passed a customer's qualification.
TRL 9	Proven in service	Shipping at rate to customers, with a production history.

How a sintered magnet is made, in one paragraph

Separated rare earth oxide is reduced to metal by electrolysis; the metal is melted with iron, boron and small additions and strip cast into flake; the flake is cracked with hydrogen and jet milled into a fine powder; the powder is aligned in a field and pressed; the pressed part is sintered and heat treated into a dense magnet; heavy rare earths are diffused in where high temperature performance is needed; and the block is sliced, ground, coated, inspected and magnetized.

Figure 7 in chapter 4 draws the middle of that chain. Each step constrains the next, and none of them can fix what the previous one got wrong.

Why grain boundary diffusion matters

A neodymium magnet loses its coercivity as it gets hot, and dysprosium or terbium restores it. Alloyed into the melt, the heavy rare earth ends up everywhere in every grain, most of it where it does little. Diffused in from the surface after sintering, it ends up concentrated in a thin shell at each grain's boundary, which is where reversal of the magnetization starts and therefore where it does the most good.



Figure 21. Grains of a sintered magnet, schematically. Amber is where the heavy rare earth sits; green is grain without it.

Illustration; real grains are irregular, and the shell is far thinner than drawn.

The catch is depth: diffusion works from the surface inward, so it suits thin parts and becomes harder as parts get thicker. That is why a diffusion process demonstrated on coupons (4.7) has not yet been demonstrated on the part that matters.

B

Basis of this report

What I read, who I spoke to, and what I could not check.

Documents reviewed

- Investor presentation, version 7
- Financial model, version 12, with assumptions tab
- Pilot line run logs, decrepitation through sintering, 2025–2026
- Fourteen strip casting campaign reports
- Magnetic test reports: company hysteresisgraph, five sample sets; independent laboratory, two sets
- Laser diffraction and oxygen analysis records
- Equipment quotations and the draft plant layout
- Supply agreements, letters of intent and purchase orders (redacted)
- Customer A letter of intent (redacted)
- Provisional patent applications (two) and invention disclosures (three)
- Team résumés and the hiring plan

Conversations

- Pilot plant visit and walkthrough, September 22, 2026
- Management call, September 29, 2026: chief executive, chief operating officer, chief technology officer
- Follow-up call, October 6, 2026: chief technology officer and process engineers

Not checked

- I did not witness a full casting campaign; the campaign reports are the company's.
- I did not audit financial statements; and nothing here is an accounting opinion.
- Three of five sample sets were measured only on the company's own instrument.
- I did not speak to Customer A or to any supplier.
- Patent and freedom-to-operate questions are flagged, not answered; that needs a patent attorney.

Method

Each process step is graded on demonstrated results, with the documents and the calls read against each other: a claim in the presentation counts for little until a run log, a measurement or a conversation supports it, and where they disagree, the measurement wins. Arithmetic in this report is mine, is labeled as mine, and states its assumptions in the margin, including where they could be wrong. Revisions after a follow-up are added as dated notes in place rather than folded silently into the text, so that a reader can see what changed and why.

THE USUAL, SAID PLAINLY

This report is a technical and commercial opinion for the use of the party that commissioned it. It is not investment, legal or accounting advice, and it should be read alongside the advice of those professionals. In this case, of course, it is also fiction: there is no Fantasy Magnets, and no investment decision should be made about it.

About Peculiar Materials

Peculiar Materials LLC is David Maybury's independent consultancy on magnetics, magnet manufacturing and rare-earth supply chains. David has run a magnet plant (as general manager of a magnet manufacturer's Swiss

operation), helped build another (developing manufacturing technology for a new US magnet plant), and led production for a defense manufacturer; he has provided technical and financial diligence on magnet, rare earth and materials companies for investors. His career has run the whole chain, from reducing oxides to metal through casting, pulverizing, pressing, sintering, grinding, gluing and testing magnets.

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