

# REDUCE SUPPLY CHAIN RISK WITH 3 PROCUREMENT STRATEGIES



## How 3 industrial leaders leverage large-format AM for efficient supply chains

21st century supply chains are global. That's great for a lot of reasons, like affordable sourcing no matter where you're located, but it also invites risk to your supply chain's stability.

What is a supply chain anyway? Simply put, a supply chain is the network from which a business sources operational materials and delivers their end product. Here, we'll focus on procurement – which is simply the sourcing. In a manufacturing context this can be whole parts later assembled into a larger product, production tooling used in an assembly (jigs and fixtures) or raw manufacturing process (casting molds), or custom machined parts to aid the product development cycle (prototyping).

Supply chain management is a complex field where employees are tasked with sourcing whatever resources their company needs. To do so they must find suppliers who can provide quality products in requested lot sizes at an appropriate cost and in reasonable delivery times ([lead time](#)). It's an elaborate task that requires a sophisticated level of involvement with large, complex networks.

So, what is “supply chain risk?” To put it simply again, supply chain risk is anything that might unexpectedly disrupt established supply chains and cause them to become “in stable.”

The far-reaching effects of a supply chain disruption can be easily understood by examining one hurdle faced by supply chain managers annually. Towards the end of January, businesses around the world ensure large orders of their usual supplies are in delivery before a routine supply disruption begins on February 16th. The date might be otherwise unremarkable for many of the countries it affects, but the beginning of the Chinese New Year – when a 15-day festival halts productivity for many of the world's suppliers – is vitally important to supply chain managers everywhere.

Experienced supply chain managers are used to this routine and can plan effectively for it. But it does demonstrate the vulnerability of international supply chains and how, if you aren't careful, events on the other side of the world can dramatically impact your business

# RISK MANAGEMENT STRATEGIES

Supply chain disruptions won't always be planned annual events. Natural disasters, health crises, political movements and more can all occur on the other side of the world but still unexpectedly halt business if your supplier is affected. 2020's coronavirus pandemic showed just how fickle international sourcing can be, and the scale at which unexpected disasters can affect businesses globally. Moreover, a global supply chain is

incredibly dependent on international transportation. This means that supply costs can be significantly impacted by changing fuel prices or stopped completely by a closed border or poor third-party planning on the part of couriers or even airports.

There are many ways to plan for these challenges, but we'll highlight three organizational systems here.

## Centralized Supply Chains

For efficiency, either cost or organizational, many large businesses create a "centralized supply chain." This is when supplies are sent from their external sources to a large, usually regional, warehouse. Think of online retailers with large warehouses full of all their products on offer. A centralized supply chain is similar in principle, but usually stores and ships supplies for a single business to which it belongs.

In a centralized supply chain, the challenge of disruptions is usually handled with excess supply. Because the space is available and a large organization system in place, a business with a centralized supply chain can stockpile their materials to

create a supply buffer. Any disruptions to their supply chain will then impact the buffer and not affect day-to-day business, creating ample time to wait out disruptions or re-source new suppliers if necessary.

While this system can be an efficient solution for large businesses with many branches using the same products, it comes at significant cost. For a supply buffer to work, serious upfront investments are required in supply purchases, real estate, and administration that are simply too much for many small and medium sized businesses.

### CENTRALIZED SUPPLY CHAINS...

Enable efficient procurement  
in one location

Allow for large stockpiles of  
supplies in case of disruption

But require significant investment  
in real estate and administration

# Local Supply Chains

A local supply chain is just what it sounds like: a supply chain system where materials are sourced from local providers. Local supply chains are most advantageous for small or franchised businesses who can be low priority for large, international providers. Because local suppliers aren't usually the largest, their lower margins often demand a higher price. But dealing with a local business can create opportunities for better, face-to-face, negotiation that results in savings. It's also an ideal system for businesses committed to an environmentally sustainable supply chain strategy – massively reducing the ecological footprint created by shipping and the costs that come with it.

Committing to a local supply chain strategy can limit the options

available to you, but it's generally sought after as an incredibly reliable strategy that removes the risk of international events impacting business. Moreover, amid international incidents like 2020's covid-19 pandemic, a local supply chain won't suffer from disruptions to international shipping – allowing you to continue with normal operations.

Along with the reliability of a local supply chain in the face of disaster is the day-to-day flexibility. Fast procurement is one of the most desirable efficiencies of local supply chains, enabling more flexible arrangements with providers that respond to the ebbs and flows of your business far more effectively than the prediction and buffering that comes with international suppliers.

LOCAL SUPPLY CHAINS...		
Ensure international policy and events don't impact business	Minimize delivery time and environmental footprints	But can eliminate more affordable international suppliers

# In sourcing

You can't get more local than in house. There's no question that eliminating supply chain dependencies outright by creating your own resources with "insourcing" is an ideal strategy that simplifies planning and investment burdens. Without any dependency on external players, your business can't be hurt by decisions or circumstances outside your own – giving you complete control of resource creation and lead time. Of course, traditionally, bringing the required production facilities in house can be an exceptional expense – especially where large parts are concerned. Fortunately, traditional production methods have been superseded

in many manufacturing contexts by industrial 3D printing.

With an industrial 3D printer, the production of prototypes, factory tooling – like jigs, fixtures and molds – or even end-use parts is an easy, hands-free process that saves time and money. Dependencies on outsourcing can be completely eliminated and expenses reduced at every stage in a product's lifecycle. Better yet, it's an easy system to combine with a local supply strategy – handling urgent needs in house for fast, controlled fulfillment and outsourcing less urgent overflow to local providers.

INSOURCED SUPPLY CHAINS...		
Considerably reduce expenses, depending on lot size	Eliminate any shipping costs and delivery times	Give your team full control of your parts and their construction

Read on to find out **how three major industrial businesses saved up to 85% of costs by 3D printing** factory tooling, full-scale prototypes and end-use parts.

For even more examples of innovative additive manufacturing applications, visit [BigRep.com](https://www.bigrep.com).

## Factory Tooling

In Kawasaki Motors Corp.'s 2.1 million square-foot facility in Lincoln, Nebraska that employs over 2,400 plant workers, 75 engineers have been given a BigRep industrial 3D printer to find innovative solutions to their unique manufacturing challenges. By applying additive solutions to roadblocks in their advanced manufacturing of off-road vehicle, light railcar and aerospace products, Kawasaki has realized some astounding cost and time savings.

While prototyping new vehicles, the engineering team builds a frame from straight raw tubing – shaping it with a CNC tube bender to form the frame's design. CNC tube bending is a highly involved process that often requires significant tooling iterations to get right.

Previously Kawasaki had to outsource their bender's profile collets – a fixture that properly orients tubes throughout the bending process. They received quotes upwards of \$500 US for parts that, since integrating BigRep additive manufacturing into their workflow, cost just \$17 to produce in house with BigRep's PLA filament.

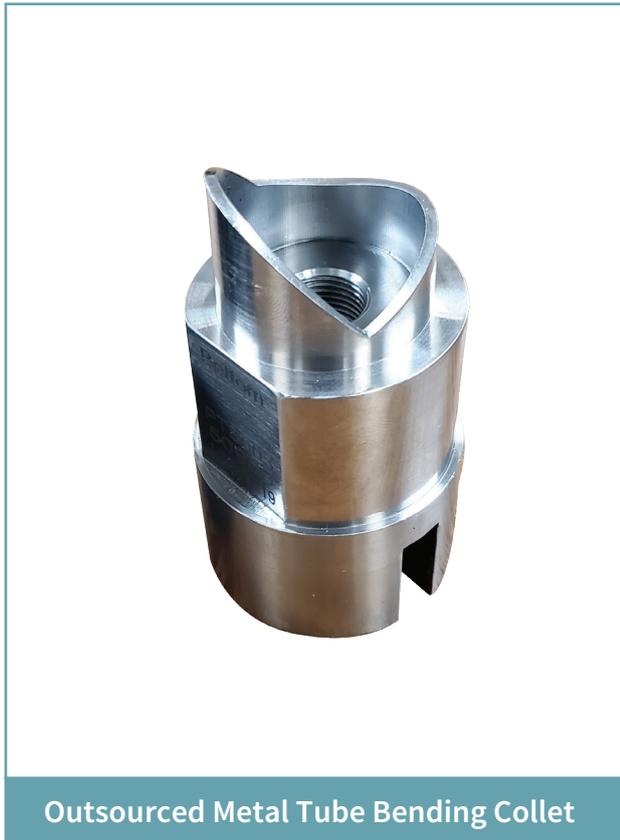
Kawasaki predicts that, in total, they've saved around 85% of expected outsourcing costs for their tube bending area by modernizing workflows with large-format additive manufacturing. But the value doesn't stop there.

With AM,  
**Kawasaki** creates  
on-demand fixtures  
in as little as 5  
hours!



Globally Kawasaki has been supplying Boeing with aerospace parts for a long time, but only began manufacturing for aerospace in the US in 2017. The production of aerospace parts has extremely high qualification standards that make it a difficult business for manufacturers to enter, and continues to cause significant delays during production as new parts and tooling are required or need replacing. However, with their BigRep 3D printer Kawasaki has a new flash tooling- production capability that they've put to use overcoming these challenges.

While manufacturing Boeing 777X cargo doors the team needed a new tool, but stringent approval processes were set to cause a serious bottleneck in production. Through an ordinary external supply chain this is an unavoidable bottleneck that could stall production for an unforeseen length of time. But, because Kawasaki had an industrial 3D printer ready, the aerospace team was able to design a mockup placeholder to align tooling and continue with their work. Kawasaki's aerospace team had their solution in just five hours and the supply chain team could source a permanent solution carefully, without the pressure of stalled production.



“ They were having issues locating a part and came up with this design. I took a look at it and what they had designed seemed easily printable, so I told them it'd be good to go. Five hours later it was ready.”

**Ross Makovicka** - *Production Engineer - Kawasaki Motors Corp.*

With AM,  
**Boyce Technologies**  
has reduced the size  
of post-processing  
teams from  
12 to 2!



## Prototyping & End-Use Parts

Boyce Technologies, prominent designer and manufacturer of products for public safety security and communications systems, are experts in manufacturing technology. In their 250,000-square-foot state-of-the-art facility in New York City, the company uses a variety of industrial tools to deliver necessary products like emergency response systems to radio and wireless networks, intercom systems, security alarm systems, customer information display systems, and integrated software systems.

Boyce Technologies are experts in traditional manufacturing processes, offering expertise with multi-axis CNC machining, laser technologies for cutting and welding, multi-axis industrial

robots, and multi-axis water jet cutting. But these technologies weren't right for some of the company's more recent projects that required ample iterating with complex geometries.

Initially company leadership was hesitant to bring 3D printers into their facility, but outsourcing the required parts clearly wasn't right for Boyce's upcoming projects either. The lead times required for external suppliers were excessive and the amount of iterations they needed only compounded the problem. Eventually, they decided investing in an in-house 3D printer was the most effective course of action.



When purchasing their first BigRep 3D printer, the planned activity was about 90% prototyping and maybe 10% end-use parts. What ended up happening was exactly the opposite.

Boyce's team noticed a non-structural aluminum element in one of their towers was deforming and disrupting signals: it needed to be replaced. They were already in production, producing and

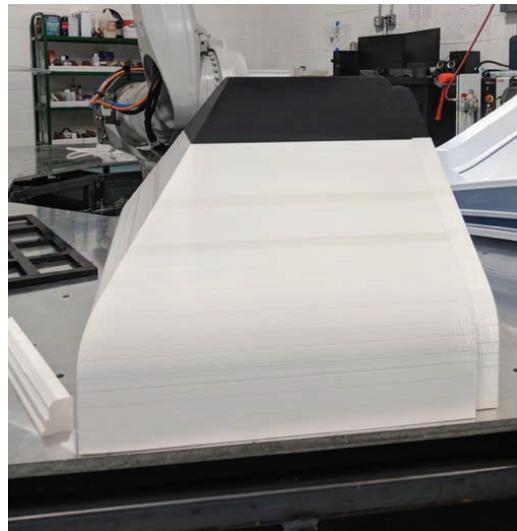
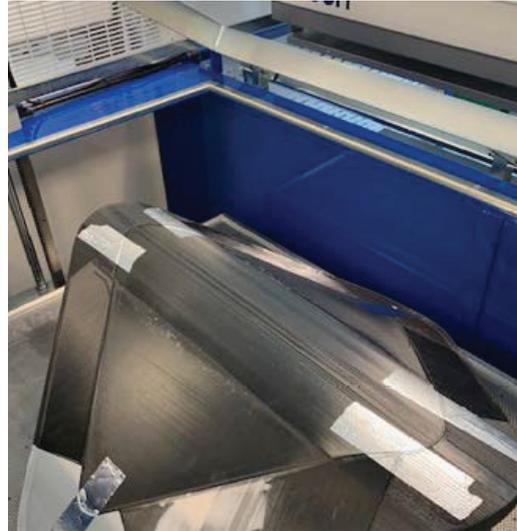
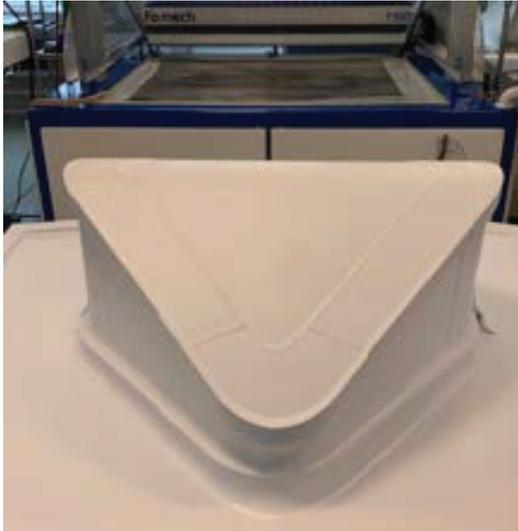
testing the expensive kiosks at a rate of 10 per week, and needed a fast, long-term solution. For many manufacturers, this is a sourcing nightmare – unexpectedly re-sourcing a defective part mid-production. Fortunately for Boyce, they realized that industrial 3D printing was the perfect solution to insource a replacement part from plastic materials that wouldn't disrupt the tower's signal.

Because of BigRep's industrial 3D printers, Boyce was able to efficiently and effectively replace their part – saving ample time and money while eliminating future supply chain risk. Following this experience, Boyce flipped their industrial 3D printer's use to 90% production and 10% prototyping.

Despite Boyce's initial hesitation, they've become additive manufacturing devotees. Charles Boyce, President of Boyce Technologies, praised the technology saying: "I used to think the fastest way to do something was to do it out of a piece of

metal. I didn't think I needed 3D printing and now I can't live without it."

With more experience in 3D printing throughout a variety of in-house applications, the team at Boyce Technologies found across-the-board benefits to bringing their BigRep into operations. This was exponentially increased when they invested in a BigRep PRO; a fully enclosed large-format 3D printer with a one cubic-meter build volume capable of printing engineering-grade materials with high repeatability.



**“At the beginning we understood 3D printing as primarily a prototyping tool, that quickly shifted into production.”**

**Ajmal Aqtash** - *Director of Advanced Robotics, Boyce Technologies.*

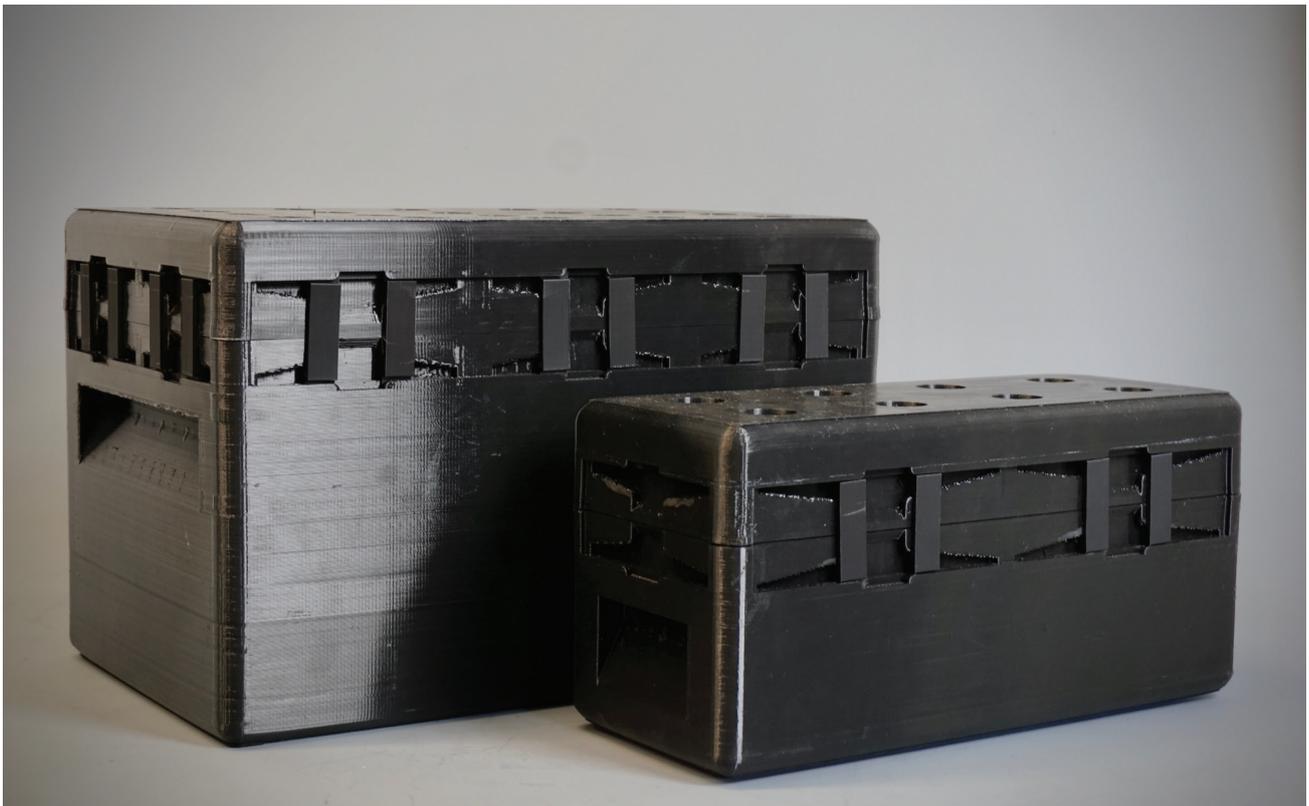
## End-Use Parts

As delicate equipment breaks down or requires off-site maintenance, organizing its transportation takes detailed consideration and significant investment. When complicated technical equipment for industries like aviation is involved, the expenses required just for logistical preparation are startling sums long before any solutions are actionable. In large part, high costs surrounding the transportation of delicate equipment are due to longstanding inefficiencies in the manufacturing of “investment shipping cases:” specialty, high-quality secure custom cases that are individually manufactured in a highly manual process and certified to transport sensitive equipment safely.

With AM, Airbus is changing lead times that exceed two years into on-demand production!



Acquiring investment shipping cases can be a complicated process as businesses plan not only for the equipment’s safe transportation, but also the time their advanced tools – often representing a significant investment – aren’t available for use. But for case manufacturers, investments in productivity must be balanced between meeting demand and spending on highly skilled laborers to create their complicated, high-standard product. Unfortunately, due to the limited number of suppliers, manufacturers’ balancing is rarely in the purchaser’s favor. As a result, wait lists for the cases often exceed two years – a disastrous lead time for businesses with unforeseen complications.



Airbus and Ralf Schlueter, Managing Director, of Flugzeug Union Süd (an Airbus subsidiary), have turned to additive manufacturing and digital design solutions to modernize the investment shipping case industry. By enabling localized supply chains with additive manufacturing systems strategically placed around the world, they’re enabling overnight production,

eliminating manual labor, and seriously reducing the shipping requirements for each new case. The new process promises a massive reduction to the cases’ manufacturing costs and lead times as they’re produced locally and on-demand, creating an attractive solution for businesses stranded by the industry’s current problems.

When Airbus first examined the supply chain and logistics problem, they found the combined expenses unbelievable. The process is generally considered the cost of doing business in the aerospace industry, but rather than accept this traditional expectation Airbus has challenged it with a modern additive solution. By working closely with BigRep's Engineered Solutions department, the additive manufacturing consultancy, NOWLAB, Airbus designed a delicate equipment shipping case that could be created with a single material on demand.

The design process takes advantage of the versatile qualities of BigRep's TPU filament which has firm material properties when printed in a thick wall but soft, flexible qualities in thinner compositions that make it highly shock-absorbent. The design of additive investment shipping cases has capitalized on Fused Filament Fabrication's (FFF) common internal infill patterns and TPU's dynamic material properties to replace the traditional foam cushioning of shipping cases. Instead the equipment's shape is simply left empty in the infill, resulting in a design that

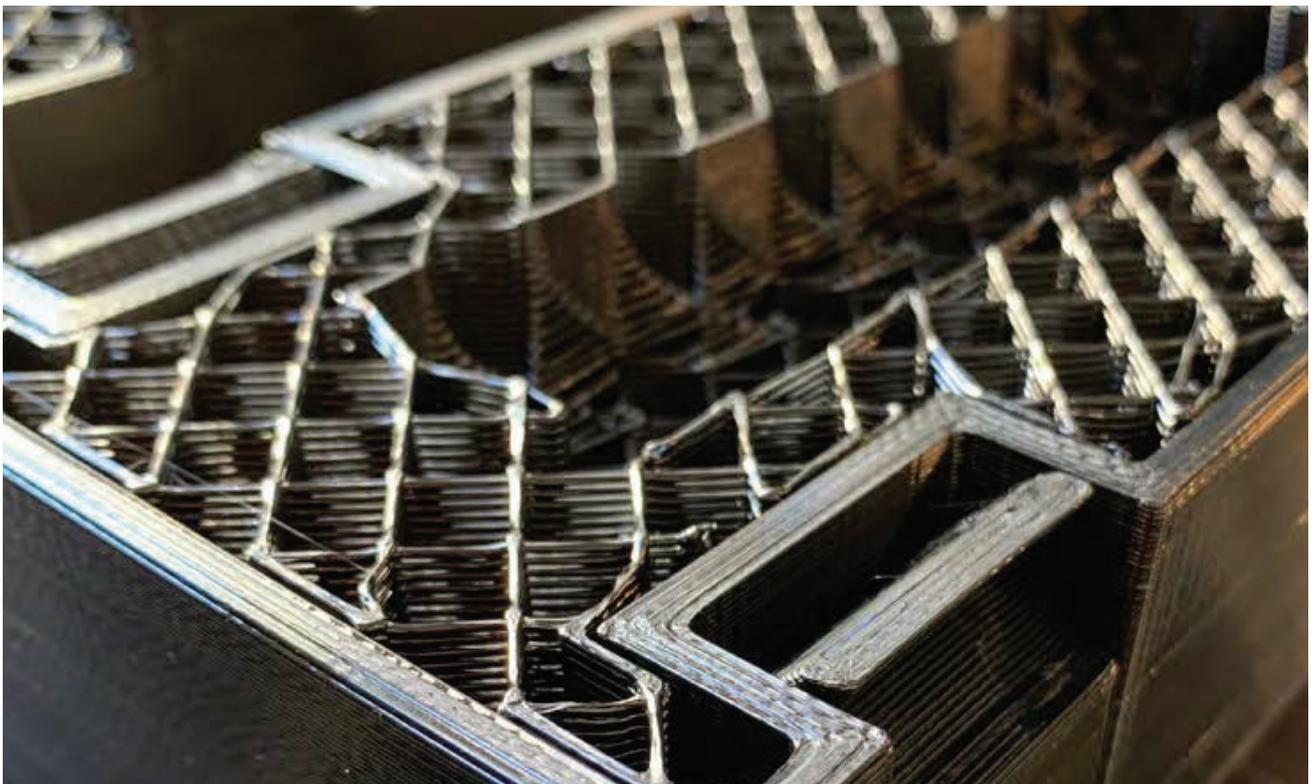
**“We’ve seen companies with over 300 refab units stuck waiting for shipment because they don’t have these cases. Some companies have even risked damaging very sensitive equipment further by transporting them in an insecure case – just carboard and Styrofoam.”**

**Ralf Schlueter** - *Managing Director, Flugzeug Union Süd (Airbus subsidiary)*

can be manufactured as a single piece in a completely automated process. Latches are created simultaneously in a second firm material and can be easily added to cases by end users.

By redesigning the investment shipping case manufacturing process around large-format additive manufacturing technology, Airbus reduced the production workflow by an astounding 50%. Coupled with the ability to create cases locally, in house and on demand to dodge the waiting lists and initial shipping

expenses, Airbus has reduced the lead time for acquiring the cases by an unimaginable amount without any of the risks associated with a larger supply chain. Their vision is to provide all necessary facilities with a BigRep 3D printer to create the cases as needed, eliminating not just the significant lead times when ordering these cases, or the high cost of production, but also freeing up a generous amount of storage that has been indefinitely allocated to these cases as nothing more than a necessary precaution.



## REDEFINING **ADDITIVE**

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