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How an upstart paper company's drive for efficiency sparked innovations in aerospace, AI, and beyond.

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## Transforming a Crisis Into a Challenge

In the 1960s and early '70s, long before he would become the head of a high-flying company that used AI to turn manufacturing on its head, Manuel Torres was a young maintenance manager at a paper-making firm in Spain. Work at the company was steady, and the paper industry was strong. But the 1973 oil embargo changed everything: Global oil prices shot up 400 percent, and the cost of raw materials that were tied to the oil market — including those required for making paper — rose astronomically, as well.



Overnight, the company Manuel Torres worked for had to slash costs just to stay afloat. For his part, Mr. Torres — a natural problem-solver with a degree from a Spanish technical training school — saw the inefficiencies inherent in the paper industry as a challenge; a puzzle to be solved. He offered the company's owner an ingenious way forward: a method to automatically splice paper from one massive roll to another, while maintaining proper tension (critical for uniform quality) during production. The solution he envisioned would not only save mountains of paper by reducing scrap, but would drastically decrease the downtime that routinely silenced the company's machines whenever an empty roll was swapped out for a full one.

## Managing the Upside of Risk

Manuel Torres' insight was exactly the sort of idea — obvious in retrospect, radical at the time — that often marks a shift from one era to another. Consider the cotton gin; the assembly line; or a digital, worldwide network of interconnected content accessible from anywhere on the globe, via the internet.

If Mr. Torres' idea was not as earthshaking as, say, Tim Berners-Lee's conception of the World Wide

Web, it nevertheless offered an elegant solution to an industry-wide problem. But his employer declined to invest in the idea, and Torres faced a crossroads. It's in such moments that visionary entrepreneurs weigh the risks and show their colors: Confident in his innovation, Manuel Torres left the security of his old job and in 1975 founded MTorres, in Pamplona, Spain — a city famed for its annual running of the bulls and long familiar with risk-takers.

MTorres found success right out of the gate, selling patented splicers to an American company, S&S Corrugated Paper Machinery in New York. In short order, major international brands like Weyerhaeuser, Georgia-Pacific, and — several years later — Kimberly-Clark and Procter & Gamble became loyal MTorres customers. By the late 1970s, MTorres was supplying manufacturing machinery to 620 clients, large and small, in countries around the world. Manuel Torres' vision, and his gamble, had paid off. *(For more insights into bold innovations across disparate industries, get your copy of [The Future Computed: AI & Manufacturing](http://bit.ly/2HwztHN) (<http://bit.ly/2HwztHN>).*)

## **From Paper to Planes to AI and Beyond**

In the 1980s, the similarities between two industries as seemingly distinct as paper manufacturing and aerospace were obvious to almost no one. But for engineers at MTorres — a company with innovation in its DNA — the hurdles faced by airplane manufacturers using carbon-fiber composites to craft wings and fuselages looked a lot like the challenges Manuel Torres had overcome when he first envisioned splicing together industrial-sized reams of paper.

By 1996, MTorres had emerged as a principal manufacturing partner with aerospace giants like Airbus, Boeing, and others, designing machines to produce ever lighter and stronger "skins" for the most advanced airplanes in the world. Today, there is hardly a jet in the air that has not been touched in some way by MTorres.

Of all the advancements in MTorres' five-decade history, however, the efficiencies driven by artificial intelligence and machine-learning have proved the most transformative. Throughout those years and well into the 21st century, MTorres specialized in building machines that could produce, cut, and splice together sheets of carbon-fiber composite, sheathing the wings and fuselage on an A350 or B787, for example, in one smooth but (by today's standards) laborious process.



Now, employing AI and machine-learning, an MTorres device can laminate a wing at 4,000 inches per minute while self-detecting flaws in real time; calculating more efficient "routes" among the millions that a machine might follow to make the airplane part; and collecting previously unimaginable amounts of data on every aspect of the job — data continually crunched and fed back into the software, where it is optimized and adapted to the manufacture of other parts of the plane.

Or take the rote, mechanistic sequence of drilling holes in order to accommodate the hundreds of thousands of rivets that, in effect, hold an airplane together. Even in the age of automation, most drills can only move so fast and still maintain accuracy. Rivet holes that don't align are worse than useless; just a few errors can compromise a plane's integrity. As a key member of MTorres' innovation team, Daniel Chavarri, has pointed out, AI-fueled lasers and high-res cameras now allow the company's machines to precisely map where to drill holes in an airplane part so they align exactly with holes drilled in its complementary part. A single part of the fuselage on a modern airliner can require up to 15,000 rivets. If AI can decrease the time it takes to drill each rivet hole by as little as a second, that's a saving of four hours. Per part. On every plane.

## Engineering a Bright Future

While his five-decade-old enterprise has evolved into an AI-powered solutions company that helps human beings travel the globe in safety and comfort — at 30,000 feet and 600 miles an hour — it's worth pointing out that Manuel Torres never abandoned the traditional, earthbound industry that launched his journey. In fact, MTorres today is a valued manufacturer in both aerospace and paper (and, for good measure, in wind-power technology).

The diversity of its products and services is emblematic of the intricate connection between manufacturing and AI. The deep manufacturing knowledge that all engineers hone throughout their

careers will shape the tech that is powering the Fourth Industrial Revolution (#4IR). The women and men working at groundbreaking companies like MTorres, meanwhile, are key to that revolution: they are the bridge between the old, the new, and the next.

*For more examples of how transformative thinking has reshaped factories and production processes around the globe, read *The Future Computed: AI & Manufacturing* (<http://bit.ly/2HwztHN>).*

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