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## A Supply Chain Perspective on Boeing's 787 Dreamliner Problems

2/12/2013 --



*Professor Ravi Anupindi says airplane maker shouldered bigger supply chain burden than ever.*

ANN ARBOR, Mich. — The Boeing Co.'s new signature airplane, the 787 Dreamliner, was grounded worldwide recently after two battery fires in separate airplanes — neither of which caused any injury — sent the company and regulators scrambling for answers. The cause of the battery mishaps is still a mystery, but it's clear Boeing has dealt with several problems and delays with the 787 — its most advanced, fuel-efficient commercial jetliner. **Ravi Anupindi**, professor of Technology and Operations, says Boeing took on a massive supply chain burden with the 787 and may have underestimated some of the risks. In this Q&A, Anupindi, who wrote **a case study** about an earlier fastener supply problem with the 787, illustrates the technological and logistical leap Boeing took with the project, the lessons it can learn for next time, and the financial implications of the plane's grounding.

**You've studied Boeing's 787 project, even writing a case study on a fastener supply problem. From your perspective as a supply chain expert, what might have happened with this battery problem?**

**Anupindi:** Right now it's very hard to say. But put in a broad perspective, the 787 has faced a lot of different problems and this is just one of several. Several of these problems can be traced to the difficulties of managing a globally outsourced supply chain. Boeing took a very big bet with this plane. The company is relying on a new technology, composite material, that hasn't been done to this extent. It's the same with the battery. To make the plane more fuel efficient, Boeing switched many of the mechanical and hydraulic systems to electrical. That eliminates a lot of weight and that helps fuel efficiency, but it requires a more powerful battery — more powerful than has been used in their planes before. Hence the move to a lithium ion battery, which packs a lot of power in a small space. Lithium Ion battery technology is commonly used in a lot of products, but it has also been associated with fires before, e.g., in laptop computers.

**So Boeing had a more complex supply chain to manage with the 787 than in the past?**

**Anupindi:** Yes and there's reason to believe Boeing may have underestimated the effort needed to manage the outsourced supply chain, from having a deep understanding of supplier capabilities, deploying resources to manage them well, provide on-site support as needed, etc. Whether this is true in the specific battery context, we just don't know yet. What led to the battery problem is still unknown. **Elon Musk**, co-founder and CEO of Tesla Motors, said publicly that Boeing's battery design is faulty, and that was echoed by an MIT professor. Tesla uses lithium ion batteries in its electric vehicles. But Boeing denies the design was faulty. The truth is hard to know right now. But the Mr. Musk's claims do raise some doubts. The more power you want to draw from a battery, the higher the risk profile. What's more, failsafe systems that were meant to prevent this kind of problem didn't work. So there is investigation surrounding the battery — its design and manufacturing, the wiring, the casing the battery is in, and possibly the entire electrical system.

**Until Boeing and regulators figure it out the 787 is grounded. How grave is the situation for the company?**

**Anupindi:** Well, this is not the end of the 787. So far about 60 787s have been delivered and two of those had the battery problem, which is not good. A fire in an airplane is an extremely

serious matter. But it will be fixed. Boeing has to fix it. It's one more issue among many with this project.

**Without knowing specifics of the battery problem, what are some lessons Boeing has learned that it can apply in the future?**

**Anupindi:** The big issue for Boeing is how to manage outsourcing on such a big project. All airplane production is complex, but this was a higher level of complexity. I think they understood the benefits, but not all the risks. Those risks are much clearer to them now, I'm sure. They'll know more about what they have to do to monitor and communicate with suppliers. In addition to components, Boeing outsourced parts of the plane's design to locations all over the world. Boeing will probably examine the effectiveness of that, whether it was a wise decision, and how it can be managed better.

**The 787 is a small part of Boeing's revenue right now since it's early in the delivery cycle, but what should investors be thinking about in terms of financial impact?**

**Anupindi:** It depends on a few things. First, what are the manufacturer defect warranty terms for customers who bought the planes but can't fly them? Is Boeing liable for the time that the 787s stay grounded? Second, the identified defect stops the production line, so there's a pipeline issue looming. There is a backlog of orders for 787 and most contracts specify a delivery date. Despite the battery fire, there's demand for the 787 and people have said it's a great machine to fly. If you miss a delivery date, there's usually a financial penalty. Even before this current problem, the project experienced delays. So the financial viability target, the number of planes Boeing needs to sell to break even on the 787, is shifting.

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