



Staffing the Space Assembly Line

M A K I N G L E A D E R S

How a group of companies tackled the challenge of creating a technical workforce for a space systems manufacturing, establishing a model for other commercial space clusters across North America and around the world.

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Escape velocity for Henry Ford

Henry Ford became a business legend by turning a big idea into one of the most successful companies in history. The big idea – mass production – was not his. It began more than 2,000 years ago with the production of weapons in China. The first industrial applications took place in Britain in the 18th Century. It was Raymond Olds who first began production-line manufacturing of cars in his Oldsmobile factory.



But Ford worked relentlessly to simplify and standardize the manufacture of the automobile, and created the assembly line system that could produce it inexpensively in large quantities with consistent quality. He also innovated in two other ways that would reshape the century. He pioneered in mass advertising to create demand for his products and in paying his employees double the going wage, reasoning that prosperous consumers would turn into his customers.

Introduced in 1908 at a cost of US\$820 (about \$23,000 today), the Model T blew open the automobile market. Its price fell every year, thanks to constant innovation, and just 10 years later, half of all the cars in America were Model Ts. By 1920, there were over 8 million vehicle registrations in the US and the number of registered drivers nearly tripled to 23 million by the end of the decade.

It is hard today to appreciate what a revolution this was. Before the perfection of assembly-line manufacturing, the automobile market consisted exclusively of wealthy people. Many of Ford's investors told him that making a better car for rich people would be his path to success. The small size of the market and high prices dictated how cars were made – slowly, with much manual labor by skilled craftsmen – like the furniture and furnishings that graced the homes of the wealthy. It was a niche business that attracted remarkable engineering innovators with names like Daimler and Benz, Peugeot and Diesel, who prized performance and built with race drivers in mind.

And then, within one generation, it wasn't.

The new space race

The description of the automotive industry before Ford Motor Company should sound familiar to anyone who works in the commercial space business. A niche business, certainly: communications satellites provide about 1 percent of global telecommunications, measured in revenue. Custom-built by skilled craftspeople? Certainly, as anyone who has visited the high bay at a spacecraft manufacturer can attest. And expensive? You bet. The traditional GEO communications satellite costs \$200-400 million all in, and has a useful life exceeding 15 years. So, it has paid to manufacture them very carefully, with no two satellites exactly alike, to generate a good return on that massive investment.

And then, in the first decade of the new century, it stopped making quite such good sense.

It started with Iridium and Globalstar, the first satellite constellations. When Iridium began designing a 66-satellite system and Globalstar specified 48 spacecraft, the companies faced a completely new need: to standardize on a single design and produce it in quantity. The companies' technical success with that goal – and the



much more daunting challenge of actually delivering a workable service – was overshadowed by the spectacular bankruptcy of Iridium only months after its market launch.

In this century, O3B (now SES Networks) became the next company to build and launch a constellation. Its 20 spacecraft operating in MEO were also based on a standard, well-established design. Then came OneWeb, which announced, funded and began production of a constellation 10 times the size of Iridium, aiming to deliver internet connectivity everywhere on Earth. Its first set of six satellites, designed to provide technical proof of concept, were successfully launched in February 2019. By then, Iridium had completed the launch of a new 66-satellite constellation called Iridium Next, capable of much higher throughput. And constellations were in development by Telesat, Leosat, SpaceX, Boeing, LeoSat and other operators both long established and brand new.