

Kubota Case Study

Towline-Based Assembly System Revs Up Production at Kubota's New North American Rough-Terrain-Vehicle (RTV) Manufacturing Plant

Designed and built by SI Systems, the new 280-linear-foot, in-floor, towline conveyor system provides variable-speed start, stop and offload flexibility for more efficient handling of production units, improving throughput 100 percent - from 100 to 200 vehicles per work-shift, reducing maintenance and boosting assembly line uptime to 98 percent. by Jim McMahon

Over the past several years, Kubota Manufacturing of America Corporation (Kubota) has been making improvements to its North American production facilities and building an innovative but flexible manufacturing structure. Exemplifying this initiative is the company's Gainesville, Georgia manufacturing plant, which in 2007 put into place a state-of-the-art, towline-based assembly conveyor in addition to its new machining, welding and painting areas, to support production of its popular line of utility, four-wheel-drive, rough-terrain-vehicles (RTVs). Key to meeting the facility's production expectations, which mandated a 100 percent increase in vehicle assembly production per 7.5-hour work shift, was the towline conveyor system's ability to flexibly maneuver the individual RTV-in-production carriers through the assembly process at variable speeds throughout the entire 280-linear-foot assembly system. SI Systems' Lo-Tow® in-floor, towline conveyor system was selected by Kubota and not only successfully met the challenge, but exceeded expectations in flexibility, throughput, maintenance and uptime, effectively giving Kubota a vehicle assembly line which is clearly a showpiece of operational efficiency.

Kubota's Rough Terrain Vehicle Line



Kubota Manufacturing of America Corporation was formed in 1988 as Kubota's North American manufacturing base. Its parent company, Kubota Corporation of Japan, was established in 1890 – an international manufacturing company with subsidiaries and affiliates that manufacture and/or market products that are sold in more than 130 countries.

The company's North American facilities manufacture and assemble Kubota lawn tractors, zero-turn mowers, sub-compact tractors, loaders, backhoes and other implements, as well as the RTV900 series and RTV1100 series of rough terrain vehicles which it began producing in 2004. The RTV series is manufactured and assembled at Kubota's 151-acre Gainesville, Georgia facility. These four-wheel-drive RTVs with dump beds carrying up to 1,600 lbs. of payload, are used for farming, landscaping, golf courses, construction sites and coal mines, and are tough enough to take on an extensive range of rough terrain and hauling challenges.

Both the RTV900 and RTV1100 series come equipped with a number of useful utility features, such as three-cylinder, water-cooled diesel engines – 700cc, 21.6hp and 900cc, 24.8hp respectively, hydrostatic power steering which makes handling the vehicle in rough terrain easier, and variable-hydro-transmission (VHT) that applies more power to the wheels when climbing hills or hauling heavy loads. The RTV1100 comes standard with a factory-installed cab, air conditioning, heater and defrost.

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Need for a More Efficient Assembly System



Until recently, Kubota was producing 80 to 100 RTVs per 7.5 hour shift. But production demand necessitated that 200 trucks be produced per shift. Manufacturing (including welding and painting) and assembly were being done in the same building and space had become a limitation. But even more fundamental, the assembly line flow was limiting the production of more than 100 RTVs per shift. No matter what the company did to improve the manufacturing line, the assembly line could not process more than 100 trucks throughput.

The assembly line system being used was a rather outdated in-floor towline conveyor which had limited capability for variable speed adjustment to accommodate different sections of the assembly cycle. If one section of the assembly took longer, the entire line would stop and have to wait for it to be completed.

The decision was made by Kubota to move RTV manufacturing into a different building, and build into that plant an entirely new assembly line, one that was capable of handling a 200 RTV throughput per shift.

For the assembly line section of the project, Kubota selected SI Systems to design and build a state-of-the-art in-floor, towline conveyor system spanning the entire 280-linear-foot assembly line.

In-floor conveyors operate on a simple concept: Carriers are pulled by an in-floor chain encased in a shallow tow track and transported to various destinations along the path. Towline systems are flexible, accommodating a mix of product assembly operations.

Assembly Flexibility Designed to Handle RTV Customizations

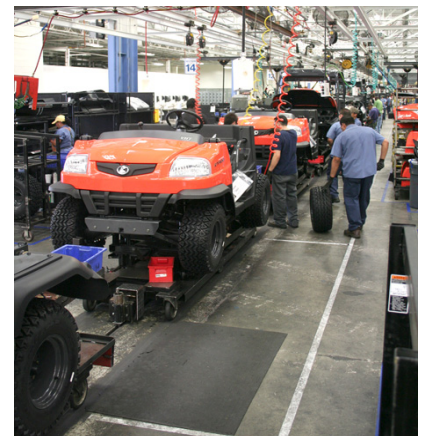
"An important criteria for the project was the ability to smoothly handle a diversity of RTV model customizations throughout the same assembly line," says Bill Casey, President of SI Systems. "The Kubota production line does not run just standard models through the system. From the weld shop and painting to the assembly, the requirements vary depending on whatever its customers ordered."

An order for an RTV900 may be followed on the assembly line by one for a RTV1100 which has a different frame, engine, enclosed cab, and many other different features. This may then be followed in assembly by another RTV900 with customized features different from the prior RTV900, and then followed again by another RTV1100 with even different customizations from the prior RTV1100. The orders are released into assembly as they are chronologically received by the plant.

As different from the prior assembly system that Kubota was using, which moved all RTVs in production at the same fixed rate, the company needed a conveyor system capable of moving the RTV production with the ability to vary speeds of the system to achieve increased production capacity as needed.

SI Systems engineered a solution incorporating its Lo-Tow® in-floor conveyor system. The system is able to accommodate volume swings at the Kubota facility by using only about one-third of its available tow-chain capacity.

Using a powered chain recessed into a floor track, loaded carriers each can be pulled effortlessly throughout the assembly process with the Lo-Tow system. Kubota's carriers



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utilize six wheels and weigh 1,500 lbs. The RTV weight is up to 2,200 lbs. resulting in a total carrier weight of approximately 3,700 lbs. per assembly. Four-sided access to carriers allows them to function as mobile workstations.

Speed options for carriers range from as low as two feet-per-minute (fpm) to 12 fpm. The synchronous, variable-speed conveyor sections provide a creeping operational mode.

The Lo-Tow also utilizes a recessed groove that is only 3-1/2" deep and 2-1/4" wide, about one-half the depth of traditional systems, making it a feasible installation for existing buildings, such as was the case at the Kubota plant.

"We thoroughly re-engineered the assembly line receiving and offloading, as well as the assembly line itself," explains Casey. "We engineered systems to handle the entire scope of the assembly environment, and make them smoother and faster for Kubota."

Seamless Assembly Loading

Before the RTVs reach the assembly line, the carriers are transported, via an automated guided vehicle (AGV) system, to various points in the plant where parts are nested into fixtures (kitted) before presenting the carriers to the towline assembly system.

Feeding the assembly line is a high-speed (60 fpm) non-synchronous conveyor section that receives the kitted assembly carriers from the AGV system and presents the carrier in what is called a frame drop station. The kitted carrier, now with frame, merges seamlessly onto the SI Systems assembly conveyor for sequential RTV build-out through the next 18 assembly stations.

"Our plant has been manually loading our welded frames into our assembly carriers," says Dustin Payne, Maintenance Facilities and Environmental Manager at Kubota. "The off-loading of the welded frames onto the assembly carrier was completely separated from our assembly conveyor. Now, when our assembly carrier is ready to receive our welded frame, it is already on the SI assembly conveyor. So, we don't have to do any pulling, retracting, or use any AGVs, and we don't have to push the frames manually. The frames come out of the paint shop and go directly onto the assembly carriers. It is a very smooth operation."



Faster Assembly Offloading

After the assembly process is completed, the SI system allows Kubota to more efficiently and quickly route the completed RTV out of normal assembly and into inspection and inventory, or off to shipping.

The assembled RTV exits the assembly line by way of a second higher speed 60 fpm non-synchronous conveyor section which presents the carrier to an unload station. Here the RTV is raised off of the carrier and onto a testing platform where it goes through inspection, then once cleared it is put into inventory or sent to shipping. The unloaded carriers then present themselves for pick-up, also through an AGV system.

"An advantage with the SI system is when offloading the RTV from the assembly conveyor it speeds up to 60 fpm," Payne explains.

"After the last assembly is finished on a particular unit, the assembled RTV and the carrier advance to final inspection on a separate conveyor section operating at a faster speed of 60 fpm. On a normal end-of-line conveyor, that last section is usually just running at the same speed as the assembly conveyor. This allows us to get that completed vehicle off of the line faster, on to inspection faster, and shipped faster."

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A More Efficient Assembly System

Kubota's new assembly system is a versatile application that has virtually eliminated downtime – system uptime is running in the 98th percentile. Production has increased from 80 - 100 RTVs produced per shift, to 200 RTVs per shift, a 100 percent increase.

"This assembly system is pretty amazing," continues Payne. "SI Systems has integrated three different material handling functions into one continuous process for assembly. It has streamlined our entire RTV assembly line."

About SI Systems

SI Systems, a division of Paragon Technologies, Inc., provides automated material handling solutions for manufacturing, assembly and distribution operations. The company is a leader in integrated "smart" material handling solutions. Its Lo-Tow[®] towline in-floor conveyor, its Cartrac[®] spinning tube conveyor, and IntelliTrak[™] overhead conveyor systems are used extensively in all types of manufacturing, assembly and sub-assembly applications. SI Systems' technology and client-specific solutions drive productivity at many major corporations worldwide.



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