Lift-off of the Ariane 5 launcher from the launch zone at Europe's Spaceport in French Guiana.

To the high heavens

Teamwork is the essential ingredient in the development of the new Vega launcher, due to be tested at the end of 2007.

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Photos: S.A.B.C.A., ESA, SKF

Since the launch of Sputnik on Oct 4, 1957, man has sent a never-ending stream of satellites into space. There are now more than 800 active satellites in orbit. Approximately two-thirds of these are used for communications, with satellites for navigation, military surveillance, observation, astrophysics, earth science and meteorology missions making up the rest. But despite the growing tendency for satellites to become bigger, a need has been identified for a smaller launcher to place lower payload satellites into orbit. Enter the Vega.

Just 30 metres high and 3 metres in diameter, the Vega launcher is due for lift-off in 2007, when it will send 300- to 2,000-kilogram payloads into orbit. The Vega is a single-body launcher with three solid rocket stages and a liquid rocket upper module. Costs are being kept to a minimum by using advanced low-cost technologies as well as existing production facilities used for Ariane launchers, Vega's older sisters.

The Vega is a joint project of the Italian Space Agency and the European Space Agency (ESA). Development began in 1998 and in 2005 a contract was signed between Vega's primary contractor, Italian company European Launch Vehicle Spa (ELV), and the Belgian company S.A.B.C.A. (Société Anonyme Belge de Constructions Aéronautiques) for the development and qualification of the Vega's thrust vector control (TVC) subsystems.

As a specialist in space vehicles, military aircraft and civil aircraft, and with a line-up of clients that include Airbus, Boeing, Dassault, EADS-ST, and Arianespace, S.A.B.C.A. is perfect for the job.

The TVC is a critical subsystem for the Vega

launcher because it ensures control of the launcher during the key propulsion phases. The TVC system comprises two electromechanical actuators, an integrated power and drive unit, a battery set and a cable harness that connects all individual elements. The integrated power and drive unit receives its commands directly from the onboard computer, which is being monitored from the base station.

"Ariane 5, the latest launcher from Arianespace, uses conventional hydraulic actuators, but for the Vega, we are using electromechanical actuators, which is a first for ESA," explains Kristof Decoster, design engineer at S.A.B.C.A., who joined the project in 2004. Decoster brings the actuators from design to implementation, examining all elements including the motor, gear wheels, screw and measurement systems.

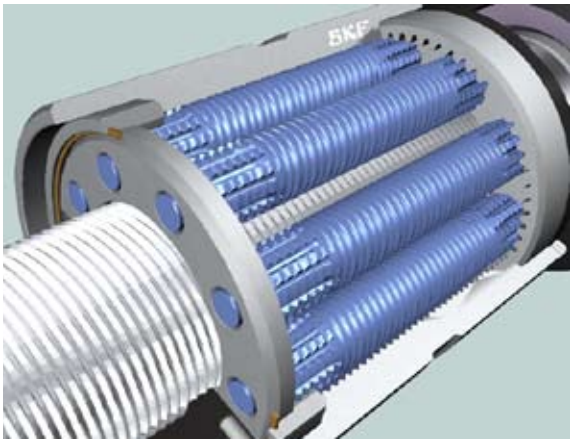
"For actuators to be used in launchers, all the environmental requirements are much more severe," explains Decoster. "They have to withstand extremely intense vibrations, very high temperatures and extreme temperature fluctuations, and they must be able to cope with a vacuum. Furthermore, prior to launch in Kourou in French Guiana, they have to be able to withstand a hot, humid and corrosive environment, exposed to dust and salt."

"I think everybody will share the same feeling as it goes up – 'There goes my baby!'"

Decoster believes that electromechanical actuators are easier to use than hydraulic actuators and that the technology is a great improvement. "Certainly they weigh less, and any savings that can be made on the weight of the equipment used to drive and power a launcher means a greater payload can be carried," he explains. Hydraulic actuators require very high-pressure vessels in the launcher to carry the hydraulic fluid, whereas electromechanical actuators simply require a battery pack. "And using electromechanical actuators will reduce maintenance, and preparing the launcher

FACTS

The Société Anonyme Belge de Constructions Aéronautiques (S.A.B.C.A.), Belgium, was established in 1920 to serve the needs of the budding aviation industry. It has since diversified into three markets of civil aviation, defence and aerospace. Today, S.A.B.C.A. has a turnover of some 112 million euros and employs more than 1,000 people in three sites in Belgium.



Above: The thrust vector control system.

From left to right: Firing of the Vega launcher's first-stage motor in Kourou, French Guiana. Artist's impression of the Vega launcher. SKF roller screw used in the thrust vector control system.

for take-off will also be easier as will be storage and testing, as the whole system is much more flexible," he explains.

"The first request for a proposal came in the late 1990s, and it took two years to define the new architecture and come up with a good enough specification for a quote," explains Josiane Evrard, senior project leader in the S.A.B.C.A. mechatronics department. "The first stage of the preliminary design ended in March 2004, and now we've nearly finished the critical design phase. The qualification phase began in early 2007 and will last six months." The Vega's first qualification launch is scheduled for the end of 2007, and if everything goes well, the Vega could go into production soon after.

The exactitude involved in producing components for space rockets is obviously extremely rigorous, but with more than 40 years of experience in space hardware production, S.A.B.C.A. has the necessary experience for such a precision job. In the front skirt of the Ariane 5 alone, there are more than 2,000 screws, and each one has to be positioned with extreme accuracy, to the nearest five microns – a job that takes some four months to complete. "It's a huge responsibility," says Evrard.

Furthermore, working in a joint project across many countries means that if any partner in any region realizes that something isn't going to work in their part of the project, it has an effect on every other part, and every other participating nation must stop, re-evaluate and re-approve the project, which is why the lead times are so long.

When the Vega finally goes into orbit, will it be painful to watch years of hard work successively exploding as the rocket goes up? "If it does what it should do, the fact it explodes isn't such a bad thing," says Decoster, smiling. Adds Evrard, "I think everybody will share the same feeling as it goes up – 'There goes my baby!'" ▫

Reliable roller screws

SKF supplies roller screws, an essential element of the actuators, to S.A.B.C.A.'s plant in Brussels, Belgium.

"S.A.B.C.A. and SKF have worked together over many years, and we have a real partnership, working closely with a lot of mutually beneficial feedback," says Candide Netchenawoe who works in the purchasing and subcontracting department for space programmes at S.A.B.C.A.

"For us, it's all about teamwork," says Netchenawoe. "And what we are looking for first and foremost amongst our supplier team-mates is competitiveness. Our big clients are always looking to reduce costs, and we must do the same with our suppliers.

She adds that proximity is also essential. "The farther away we are from the supplier, the greater the transport problems," says Netchenawoe. "And of course, quality and reliability are of huge importance."

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