Sky_liner

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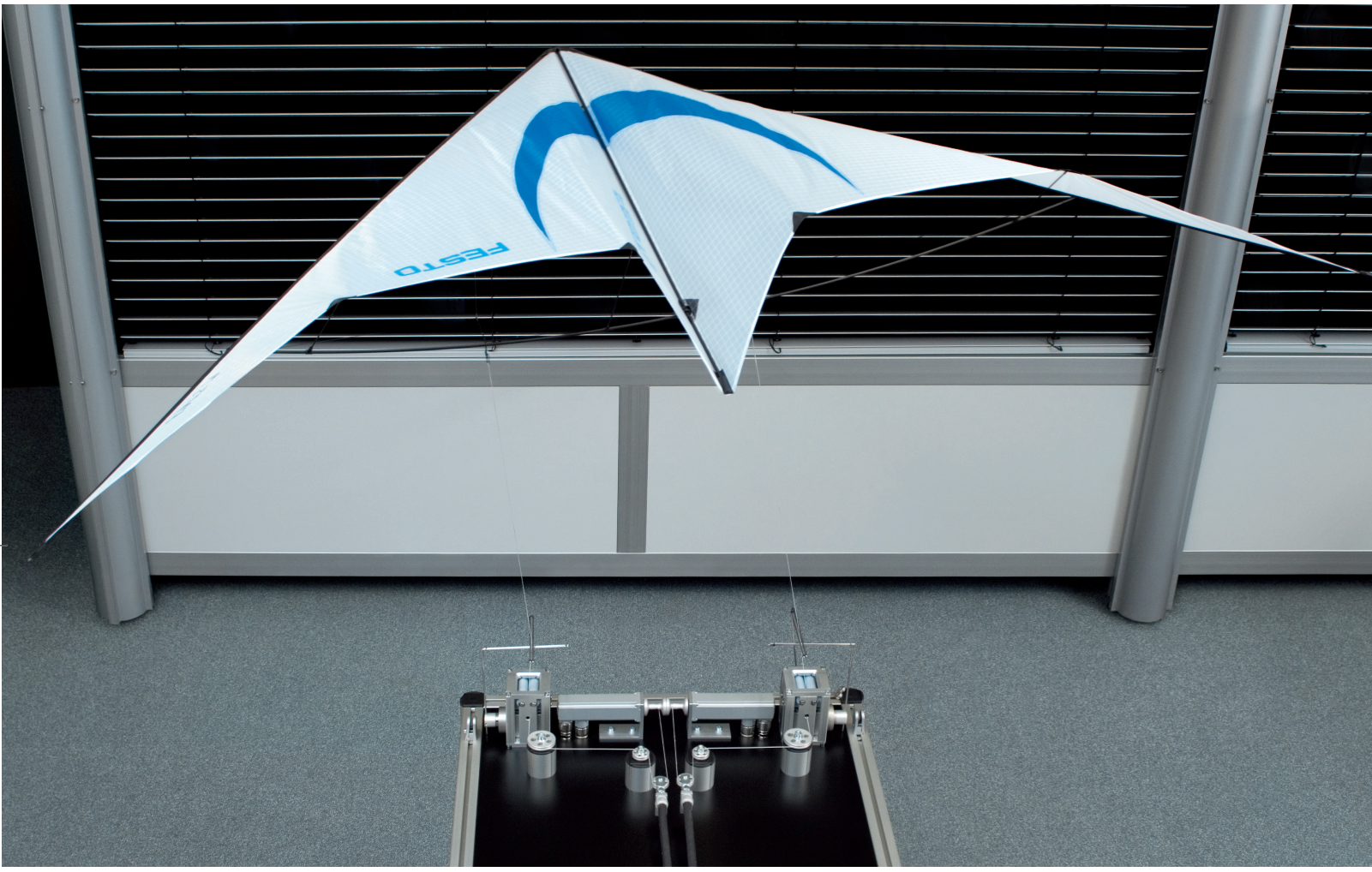
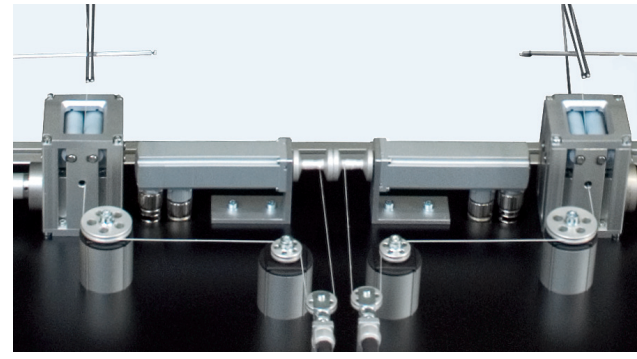


Dual-line kites
with mechatronic control

Info

A combination of mechanics, electronics and aerodynamics

Dual-line kites, each with one control unit



Servo motors

The people of ancient China and Japan believed they could use kites to convey their wishes and desires to the gods. Kites continue to fascinate people from a wide range of cultures to this very day. Flying a kite calls for a great deal of skill. With the Sky_liner project, Festo is demonstrating for the first time that a kite can be controlled fully automatically by means of mechatronics, and is thereby forging a link to its key field of competence: automation by means of flowing air.

The oldest extant European representations of kites of various forms date back to the period between 1326 and 1618. The kites depicted had been brought from China and Japan. They were small, rudimentary models that were not widely circulated and were used by children as toys; these kites could be borne aloft in the air, but were not controllable.

It was only in the early 19th century that the Englishman George Pocock became the first European to develop a steering system for kites.

In England and France, he was granted a patent for this kite control mechanism in combination with the innovative use of wind energy.

Pocock, the universalist pioneer of kites, had discovered that in combination with wind, they could serve as highly effective traction systems for operation on water, on land and in the air.

The flying kite's line was firmly tied to a coach or boat. To enable travel in a specific direction, George Pocock devised a configuration of ropes for the front of the kite with two control lines, which were sufficiently long for the kite to be manoeuvred in the desired direction from the coach or boat by drawing or slackening one or both of the lines. This controlled movement of the traction kite provided propulsion – to the left, to the right or straight ahead with the wind.

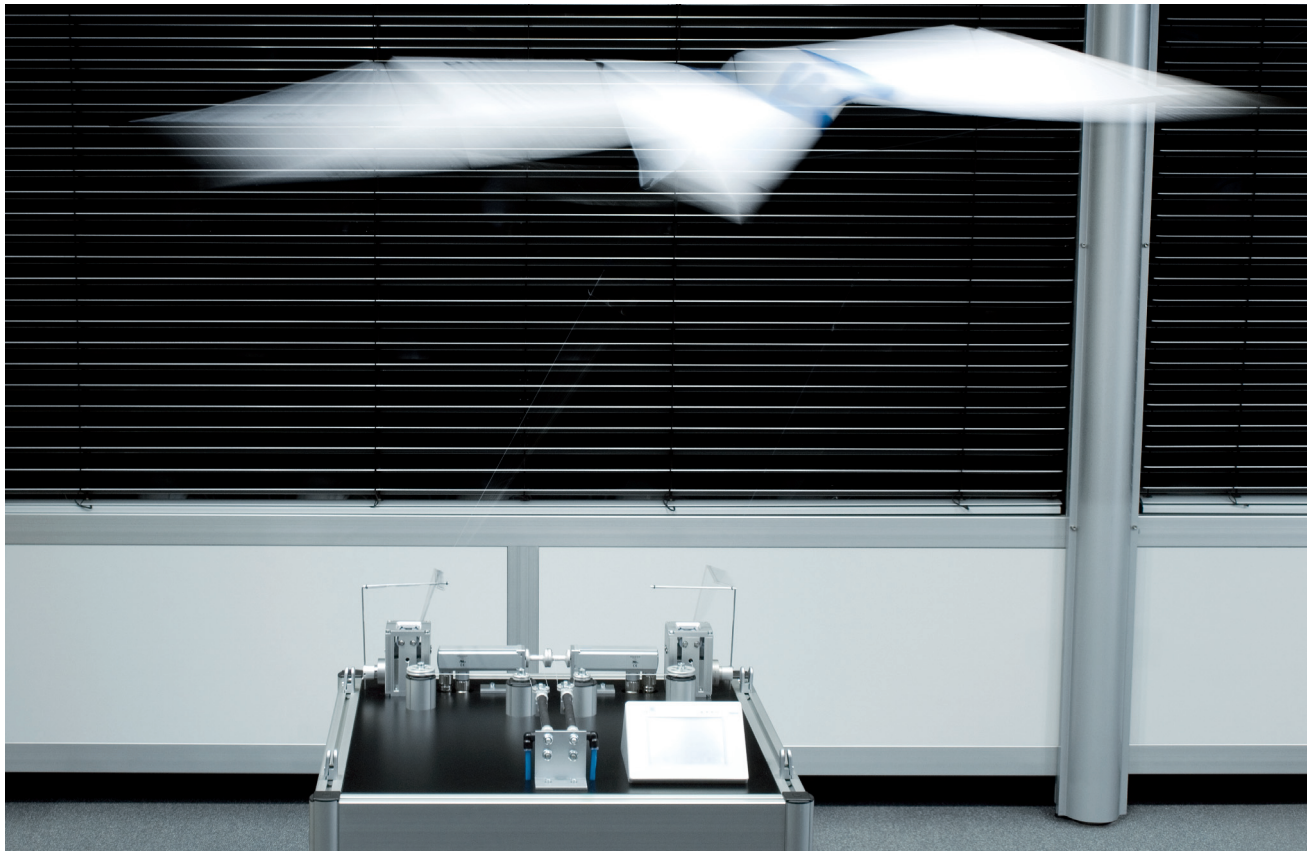
Operation of a manned airborne gondola attached to a kite was based on the same principle; however, the kite was controlled from the ground.

Pocock's dual-line control technology was later improved and extended by Orville and Wilbur Wright to such an extent that they were capable of executing geometrical figures with their aircraft kites.

In the second half of the 20th century, special forms of controlled kites were developed in the USA and Europe. These airborne acrobats were supplemented with innovative control systems that enabled them to carry out intricate artistic manoeuvres.

Sky_liner comprises a configuration of two dual-line kites, each controlled by a mechatronic unit. These kites are thus no longer flown by hand, but automatically operated from indoors. The wind for each unit is generated by a total of 22 axial blowers and can be oriented in a specific direction by means of vanes positioned in front of the blowers.

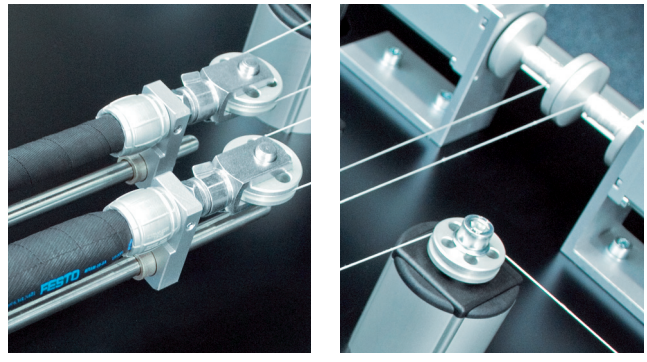
The two control units can intercommunicate, so the kites can be controlled and flown either independently or in synchronisation.



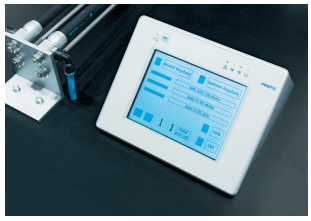
Each kite line is wound on a reel driven by a servo motor, which can simultaneously either release the line or draw the kite in. The kite can be steered in the conventional way by retracting one of its lines.

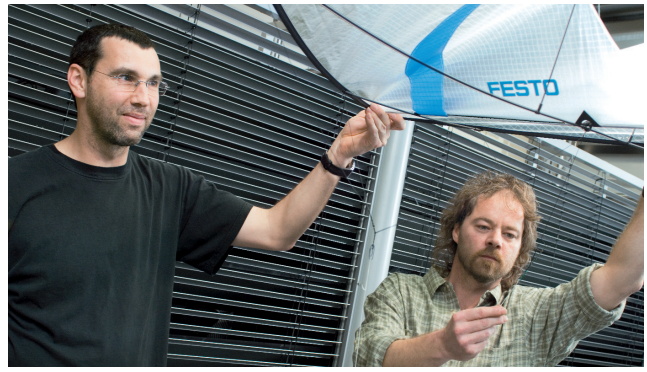
The expertise lies in the details: the kite can be held in position by an intelligent control system, even in changing winds. For this purpose, mechanical potentiometers register each lateral movement of the lines. Each line is coupled to a DMSP pneumatic muscle from Festo, which contracts and thus “shortens” the line to counteract this movement of the kite. To ensure rapid response, the pneumatic muscles are activated by fast-switching valves from Festo, which react to the signals from the potentiometer. If the control range of the pneumatic muscles is not sufficient, the servo motors can be activated as a supplement to this regulatory process. The servo motors are also used to deploy and recover the kite.

With its Sky_liner project, Festo is demonstrating the further opportunities that lie in the combination of mechanics, electronics and aerodynamics. Whereas automated control of a kite used to be difficult to imagine, this project has shown that it is indeed possible using a holistic mechatronic approach. Components from Festo and their intelligent control and interaction constitute the basis of Sky_liner.



Contraction with the pneumatic muscle





Technical data

Master control unit:	programmable logic controller PS1
Motor control unit:	2 motor controllers for each of the servo motors SEC-AC
Operator panel:	front end display FED-120
Servo motor:	MTR-DCI
Fluidic Muscle:	2 MAS 10

Project partners

Project initiator:
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