

Control Engineering Month

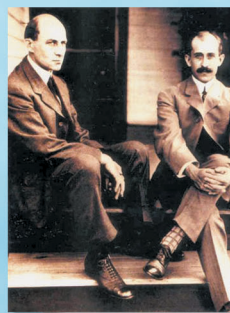


"First and most significant, the brothers recognized that the most important problem they faced was that of control. All else was secondary."

—R.P. Hallion, *"The Wright Brothers: How They Flew,"* *Invention & Technology*, vol. 19, no. 2, Fall 2003.

"Orville...stipulated that the 1903 airplane should remain in London after his death unless the will was amended by a subsequent letter from him indicating a change of heart."

—Tom Crouch, *The Bishop's Boys*, Norton and Co., 1989, describing Orville's feud with the Smithsonian.



USAF HISTORY CENTER

There is no "Control Engineering Month," but if there were one, I would vote for it to be December. One hundred years ago this month, Wilbur and Orville Wright demonstrated manned, powered, and controlled heavier-than-air flight. This singular event, born out of raw perseverance and ingenuity, is arguably the greatest achievement in control engineering as well as one of the greatest technical achievements of any field. (I say "arguably," since the feedback amplifier was comparable in its impact, but that's another story.)

Despite this accomplishment and its effect on our civilization, we sometimes find ourselves hard pressed to articulate the achievements of our field. What exactly did the Wrights do that could be considered control engineering? First, the brothers understood that inventing the airplane required that they also learn to fly it; in fact, Wilbur once described learning to fly as learning to ride a "fractious horse." They were the controller in their control system.

While the pilot could provide sens-

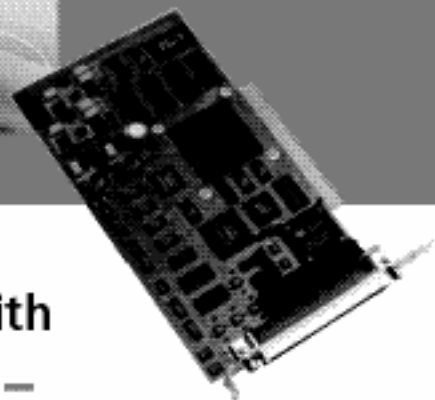
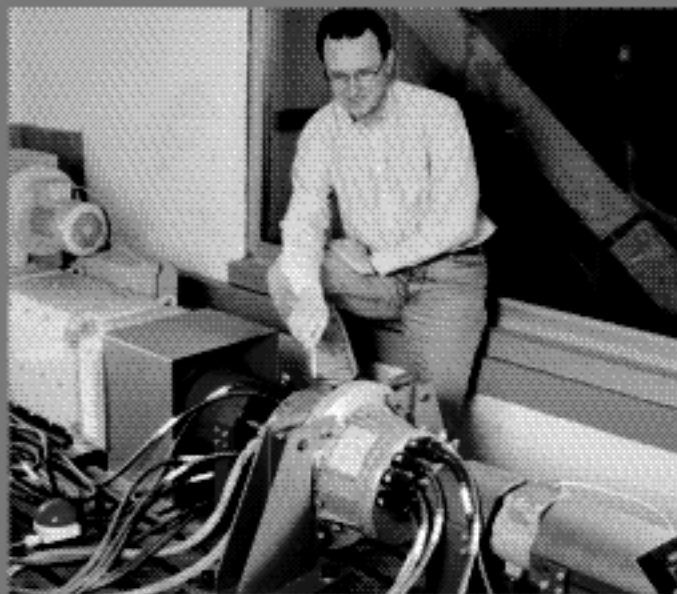
ing and processing, mechanical actuation was needed in the absence of feathers. With hindsight, it's obvious that three axes of motion require three independent actuators. But this is not a lesson that can be learned from controlling a ship, which needs only a rudder, its buoyancy and center of mass giving it stability in pitch

and roll. Of some help was the brothers' insights into bicycle dynamics, an unexpected benefit of their day job.

The Wright brothers knew that, without control, their airplane would not fly. In addition to a rudder and a forward elevator, they actuated motion about the roll axis by means of wings that could be warped. With



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these control surfaces, they were able to maneuver their airplane as it moved through the air.

What do we learn from the Wright Brothers and their accomplishments? A lot. They invented and built what they needed as they went along: a wind tunnel, a force balance, efficient propellers, and more. They were as hands on as hands on can be. They worked in a small team, two brothers and an engine mechanic. But it's hard for us today to imagine what it was like. I sometimes wonder how they interacted during the winter months of building and testing. No e-mail, no progress reports. Meetings? Photocopies? How did they do their purchasing? Was everything snail mail, delivered by railroad? The telegraph helped, but there was no overnight delivery (airplanes weren't invented yet!) and not many long distance telephone calls (the negative feedback

amplifier was also yet to be). It boggles the modern mind to picture it. But despite all of this, they invented the airplane faster than it takes most modern-day students to get a Ph.D. in control engineering.

We also learn this: That great acts of creativity often require great dedication and great sacrifice. Neither brother married; their work was their life. And they were "unfunded," as if the term even had meaning in that day. They just did it.

And, finally, we learn this: That to engineer great things does not necessarily guarantee enjoyment of the fruits of one's labor, in money or recognition. The Wright brothers squandered their lead by choosing secrecy over continued engineering, while others demonstrated their own vehicles, however less capable, to an awed world. Like many cases in the history of technology, Orville

spent much of his later life defending the credit that he and his brother rightly deserved.

It's overwhelming to look back at this remarkable saga and the 100 years of flight that followed. As control engineers sitting over the wing on a typical business trip, we watch the humble flap as it tilts alternately upward and downward, inscrutably but deliberately, and we think to ourselves: "All other considerations are secondary."

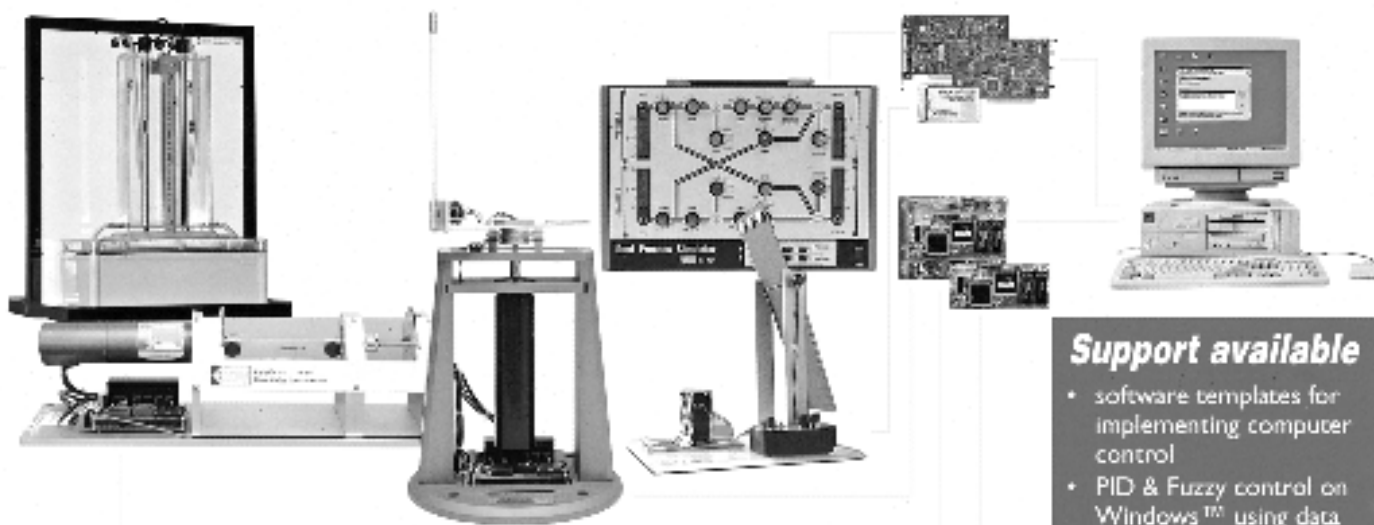
Have a good month.



Dennis S. Bernstein
Editor-in-Chief

IEEE Control Systems Magazine

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