A dream of wings—via feet

Superman's strength and X-ray vision are as nothing, to his earthborn observers, compared with his ability to fly under his own power. Even among people who pursue no such conscious goal, flight is a recurrent theme in dreams, whether as physical escape or as a metaphor for a more psychological yearning. On Aug. 23, Bryan Allen climbed aboard a fragile, winged craft named the Gossamer Condor, strapped his feet to a pair of bicycle-like pedals connected through a linkage to a 13-foot propeller, and flew.

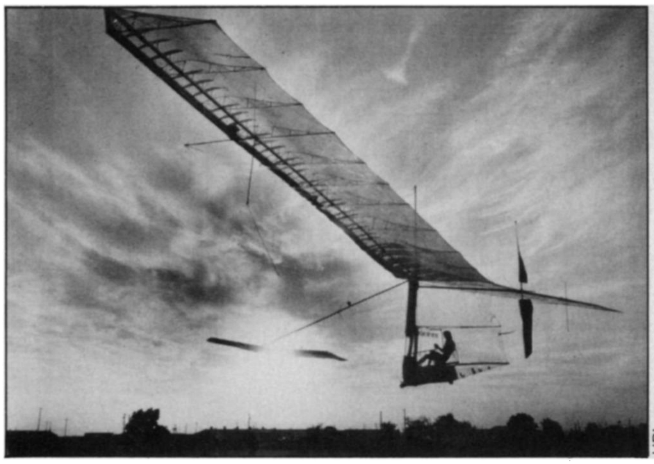
He was not the first. One early flight took place in 1929, when Hans Werner Krause flew an "ornithopter" designed by Alexander Lippish, for 300 yards, using his feet to flap the craft's delicate wings. Allen estimates, in fact, that 30 to 40 aircraft have successfully flown—not just glided—using human muscles as their only source of power.

A major difference, however, was that Allen's flight met the conditions necessary to win the "Kremer prize," an award equivalent to 50,000 pounds sterling, contributed by British industrialist Henry Kremer to inspire just such efforts. Kremer first offered a 5,000 pound prize in 1959, open only to British attempts. In 1967 he doubled the amount and opened the competition to all nationalities, still with no successful takers. The amount was raised to 50,000 pounds in 1973.

Yet, except for the participants, the money may be beside the point. What the competition did do was provide a strict set of rules against which the entrants would be judged. It was not the first of its kind (the Italian government offered a sum in the 1960s equivalent to Kremer's original prize), but it did mean that the winner would be truly flying, not just providing an occasional supportive nudge to a glider.

The Gossamer Condor effort was organized by Pasadena engineer Paul D. MacCready, who designed the craft together with Peter Lissiman. The design was translated into hardware by Vern Oldershaw, using a mylar wing surface over bent metal ribs along tubular aluminum spar, with piano wire for bracing and cardboard for the wing's leading edge. The 10-foot-long fuselage was suspended beneath the 96-foot-wide wing, which also carried a strut leading forward to a smaller wing, or canard. The entire construction weighs about 70 pounds; Allen, according to Allen, weighs about 135.

The conditions of the attempt, as set up by the Royal Aeronautical Society of England, required the flight to cover



UPI

Bryan Allen pedals the Gossamer Condor above Shafter, Calif.

a figure eight around two pylons half a mile apart. The craft had to take off under its own power (no slingshots, for example), from nearly level ground (a slope no greater than 1 part in 200), and to cross the start/finish point at least 10 feet above the ground.

The Condor taxied along a runway at Shafter Airport in Shafter, Calif., on small wheels, driven by the push from the aft-mounted propeller, until it developed enough lift to rise from the ground. The craft's maximum speed is about 12 to 13 miles per hour, Allen says, and stall speed is about 7. During the prize run, he was pedaling at from 80 to 90 revolutions per minute, with slight gearing (1.2:1) producing a propeller speed of 96 to 108 rpm. The flight lasted 7 minutes and 28 seconds, of which 6 minutes 22 seconds comprised the official run. The craft has accumulated a total of about 6.5 hours of time aloft since it began flying in March, says Allen, including about 10 attempts at the prize and a maximum duration of some eight minutes for a single flight.

Allen believes that human-powered aircraft are unlikely ever to become "practical"—even minimum performance, he feels, is too close to maximum human capabilities. Such a craft might, however, work wonders with the addition of a small, 1.5-to-2-horsepower engine. "Imagine," he says, "flying across the country on six gallons of gas. At 30 miles per hour." □

jects easier to digest by the new population of students entering the educational system. More diversity, not less, is what is needed, the panel says. Texts and classes should offer stimulation and challenge to all levels of students, not just the lowest common demoninator.

Harold Howe II, vice chairman of the College Board panel and vice president of education and research for the Ford Foundation told SCIENCE NEWS that "lack of confidence of society in itself is depressing the attitudes of children. We're asking people [in reading this report] to pause and think about what affect these attitudes are having on our children."

Sandra Clark, a panel member and head of the English department at a Bellevue, Wash., high school, says we have to rethink what it is students are learning in school and what it is society thinks they ought to learn. Perhaps lower achievement expectations are the price we have to pay for educating increasing numbers of students. Benjamin S. Bloom, another panel member and Distinguished Service Professor of Education at the University of Chicago, disagrees. He points to the Japanese, who educate an even larger percentage of their population than the United States does, as proof that the masses can be educated without watering down the quality of student achievement expectations. □

Nitrogen fixation: A piece of the action

The future will demand more food, and food production demands that nitrogen be converted from its atmospheric form to biologically useful ammonia. But providing nitrogen fertilizer by the industrial processes available today will lead to ever-increasing fertilizer prices and continuing massive consumption of nonrenewable fossil fuels, William E. Newton of the Charles F. Kettering Research Laboratory told the meeting of the American Chemical Society this week in Chicago. "Such a situation will be devastating for all nations," Newton warns.

Newton and other researchers studying nitrogen fixation expect to find the key to the fertilizer dilemma by learning from the system that most efficiently converts nitrogen to ammonia without high temperature and pressure. That system is the enzyme nitrogenase, which is found in certain bacteria, some of which live on the roots of soybean plants and other legumes. Isolated in the laboratory, the enzyme demands only about half as much energy as does the industrial process. But to imitate the bacterial enzyme, chemists need to know the details of its operation.

Researchers have long known that an essential cog in biological nitrogen fixation is a "cofactor" that contains the metal molybdenum. However, that com-