FALL 2000

Flapping Wings

THE ORNITHOPTER SOCIETY NEWSLETTER

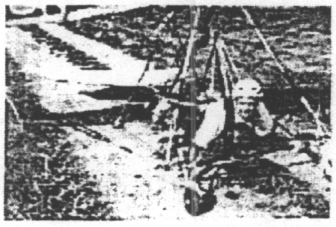
URVAM

Union Pour la Realization du Vol Athletique ou Minimotorise

In this issue, we have several articles translated from the newsletter *URVAM Express*. URVAM is a French organization dedicated to human-powered flight by flapping wings. Much of their research has been done with converted hang gliders built by Yves Rousseau and Patrick LaGrange.

Yves Rousseau's "Puicynamie"

For several years now, we have researched the use of flapping-wing hang gliders. We found that these pedal-actuated craft can maintain altitude for 50-100m after a tow launch. This has been witnessed on more than 100 flights. The first flights were done with limited flapping amplitude to preserve stability. Then, a horizontal stabilizer was added and the amplitude increased. This resulted in several flights of limited duration. Now, a new system of wing twisting is being tried. It is hoped that this will increase duration and perhaps bring climbing flight.



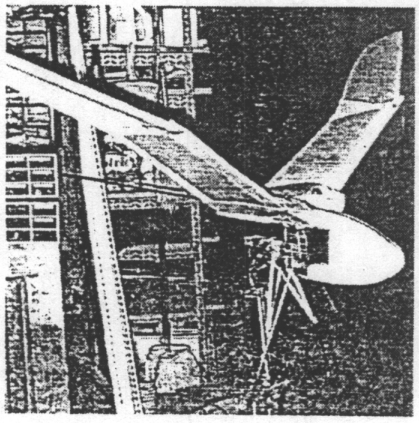
Yves Rousseau at the controls of his flapping-wing hang glider.

Skybird Goes to France: Part II

A meeting was held in Boissy in September. It was a gathering of unconventional models. All sorts of models showed up: canards, annulars, quadruplanes to name a few. Albert Kempf was expected to bring Truefly but could not come. However, Dr.Robert Korobelnik brought a Skybird from Sean Kinkade. A member of URVAM, Korobelnik has created a web site about ornithopters in France. It can be found at http://perso.worldonline.fr/ovirc/index.htm.

RC Wing Articulation

Another ornithopter was present at the meet. Although unfinished, the ornithopter has fully articulated wings. The wrist joints are located at 2/3 span. They reproduce the movement of a bird's wing with upstroke folding. We hope to hear more when this model is complete.



Flapping and Fixed Wing Compared

by Nathan Chronister

There are three ways of considering the advantages and disadvantages of flapping flight. One is to look at birds. One is to model flapping flight mathematically, using a computer. The third is to build a flapping wing aircraft and see how it performs.

1. Look at birds. This approach shows us what flapping flight is capable of, giving proof by example. Its limitations are two: The largest living birds are somewhat smaller than manned aircraft, and we need to be careful if we are to extrapolate performance data to larger scales. Also, birds show us what flapping flight is ultimately capable of, but our technology may fall short of what birds have accomplished. What birds show us, though, is that flapping flight can be very efficient, consuming less power for a given body mass, wing loading, and distance traveled than most fixed wing aircraft. Birds also demonstrate incredible maneuverability, but limited speed, when compared with fixed wing craft of the same size.

2. Mathematical models also suggest high efficiency, in some cases superior to that of fixed wing aircraft, or helicopters in the case of hovering flight. Mathematical models can handle manned ornithopters, but conclusions at any scale need to be taken with a grain of salt. Just as our machines cannot match the complexities of bird flight, our

simulations are a crude approximation of the real thing, at least for now.

3. Constructed ornithopters show efficiency ranging from poor to near that of fixed wing aircraft. Radio controlled ornithopters have not yet matched the agility of fixed wing model aircraft. The problem is, here we are looking at what has already been accomplished rather than what one day is possible.

I suspect one of the main reasons we haven't more fully utilized flapping flight has nothing to do with materials or mechanics. The greatest problem is a lack of funding. A civilization that can send a crew of three to the moon and back could certainly fly a man on flapping wings. Historically, the rapid success of fixed wing aircraft diverted funding away from the development of ornithopters. Ornithopter research has been marginalized to the point where individuals have to scrape together money to build their machines. There are technical difficulties to overcome, but the lack of funding rather than the laws of physics explains why they have not been overcome yet, at least for a manned ornithopter or one that can match the maneuvering ability of birds.

These questions about Manned Ornithopters were submitted by Emma O'Loughlin and answered by Nathan Chronister:

Q. What attributes in materials would have to be created for us to use flapping flight to build aircraft which could carry people and cross reasonable distances? At present what materials don't exist which making an extremely successful ornithopter would require?

A. One manned ornithopter project, which you can see on the FF web site in the photos page, is on the verge of successful flight. It uses carbon fiber, aluminum, steel, and other pretty standard aviation materials. I think that is all that will be needed. The wing structure, consisting of a hollow carbon main spar with wing ribs made of a special plastic foam, must be made to twist as it comes under load from flapping. That requires a different structure than fixed wings.

Q. What movement would flapping flight create at the body of a plane? Would it be practical to travel in?

A. A manned ornithopter would flap its wings about once per second, and the fuselage would rise and fall at the same rate, reaching its highest point just after the beginning of the upstroke. I'm not sure how this would affect human occupants. It might be disconcerting for some, especially the pilot, but you might get used to it the way you get used to the constant movement of a boat. It is possible to cancel out the effect by using a second pair of wings that beat opposite to the first pair.

Q. Is one of the reasons f.f may not be utilised for larger aircraft, such as passenger flights, that nothing f.f can offer would be more advantageous than regular stiff wings aircraft?

A. Flapping flight becomes less advantageous at larger scales. Power requirements increase slightly, whereas for airplanes they decrease. Also, the inherent low speed of ornithopters will limit their use for passenger transport.

Q. You mentioned that you believed f.f will be utilized more in the future, is this mainly because technology has improved enough, because its advantages in certain areas are being recognized...?

A. The potential advantages of flapping flight have long been known, but the improving technology will allow us to take advantage of it. Also, only with recent technological improvements have people been able to take the idea of flapping flight seriously. However, flapping flight will always be limited to certain roles. The best applications will be in small, unmanned aircraft that require stealth or close-in maneuvering rather than speed. (Birds are silent not only because they lack engines, but also because they lack propellers. The noise of an airplane comes from both.) A few hundred years from now such machines could hop around autonomously, carrying out all sorts of tasks. Maybe they could even pick bugs off of crops!

Q. Could flapping wings, in theory, support an airliner ? What size of wings? How many beats per minute?

A. It's not against the laws of physics, but might be impractical. Turbine engines produce enough power to fly such a machine. The problem would be building it strong enough and light enough.

Postal Contest Last Chance!

Akihiro Danjo is the current leader in the Millennium Postal contest. He leads both categories with flights of over 6 minutes! There is very little time left, and all entries must be in by February 15! You've got to be in it to win it!

Special thanks to Sean Frawley for putting together this issue!

MILLENNIUM
INTERNATIONAL ORNITHOPTER POSTAL CONTEST

This year, for the first time in almost two decades, builders of flapping-wing aircraft will have an opportunity to compete internationally. In fact, the Millennium Ornithopter Postal Contest allows you to compete with people around the world without leaving your own town. Entries will be flown locally and their flight times will be sent by mail. Typically, contestants will fly their models at a local or national indoor contest and have the local contest director sign the entry form to verify the flight times, but other forms of evidence (witness signature, videotape, etc.) may be accepted at our discretion. There is an Open category for any flapper-propelled aircraft and a special Flapper Lift category for aircraft that meet certain restrictions on fixed wings. We wish you luck in this exciting and unique competition.

GENERAL RULES

- There is no entry fee.
- Each entry must include:

1. Entry form, completed and signed. The local contest director's signature is required unless the contestant provides other proof of flight duration (e.g., videotape) deemed suitable by OS postal contest director Nathan Chronister.
2. A scale 3-view drawing or clear 3-view photos of the model, with pertinent dimensions of model and motor.

- All entries must comply with the Design Requirements.
- The OS contest director has final authority to decide on compliance with rules.
- Flights must be made in the year 2000 and entries *received* by 15 Feb 2001. Send to Nathan Chronister, PO Box 376, Arkville NY 12406 USA.

SECTION 1: TO BE COMPLETED BY CONTESTANT

Name: _____
Address: _____
Name and date of local event: _____
Organization sponsoring local event: _____
Name of local contest director: _____

☐ Category A (open) ☐ Category B (flapper lift)

SECTION 2: TO BE COMPLETED BY LOCAL CONTEST DIRECTOR

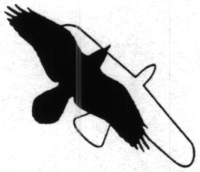
I certify that the contestant named above flew an ornithopter (flapping-wing aircraft) for a duration of ____ minutes and ____ seconds, and that the same ornithopter met the Design Requirements below. Signature: _____ Date: _____

DESIGN REQUIREMENTS

- An eligible model is propelled solely by flapping wings or small flapping fins.
- Models must be flown indoors and launched by hand within two meters of the floor.
- Power must be provided by a rubber motor.
- If the entry is for *Category B*, the following *additional requirements* must be met:
  - All non-flapping lifting or stabilizer surfaces must be aft of the rear motor hook. This applies to stabilizers, fixed wings, fixed portions of flapping wings, fuselage structures that could produce significant lift, etc.
  - All wings must have the same flapping rate and roughly the same range of motion.

THE ORNITHOPTER SOCIETY

Industrial Evolution
PO Box 376
Arkville NY 12406 USA



Ornithopter Society Membership Info

Join the Ornithopter Society or renew your membership: Dues are $12 per year in the USA. Dues outside the USA are $17 US per year. Checks are payable to *Industrial Evolution*.

Get published: Nathan Chronister, editor of *Flapping Wings*, invites you to send your articles and photos to be published in this newsletter. Send your material to the address above or E mail it to evolution@catskill.net.

www.catskill.net/evolution/flight

Sean Kinkade Claims Engine-Powered Ornithopter Trophy!

The Ornithopter Society's long-running Engine Powered Ornithopter Contest, announced in 1986, ended in October when Sean Kinkade of Chuluota, Florida, submitted a video of a qualifying flight. Fourteen years ago, when contest director Patrick Deshaye initiated the contest, the ornithopter community had not yet rediscovered the work of Percival H Spencer, who flew a series of successful engine powered ornithopters in the late 1950s and a radio controlled ornithopter in 1961. It seemed no one had ever built a successful engine powered ornithopter, and the field was sorely in need of innovation. Deshaye donated a beautiful bronze trophy, pictured here, to encourage and reward the development of engine powered, flapping-wing aircraft. Soon, several engine powered ornithopters had flown. In 1991, Deshaye himself flew a biplane ornithopter powered by a .020 model airplane engine. The same year, Jeremy Harris and Jim DeLaurier produced a larger, radio controlled ornithopter that flew quite well. And in 1997, Sean Kinkade built and flew the radio controlled ornithopter that would lead to his Skybird ornithopter kit. None of these, however, met Deshaye's stringent criteria. The ornithopter not only had to stay aloft for at least two minutes. It also had to take off from the ground, using only its flapping wings to power the takeoff. Hand launch had become the preferred technique for engine powered ornithopters, so the prize went unclaimed. Finally, after much prodding from Deshaye, Sean Kinkade mounted wheels on his radio controlled Skybird ornithopter and made a series of rise-off-ground (ROG) flights, documented on video, to claim the prize.

One earlier ornithopter may have qualified for the contest, if it had been entered. This was Valentin Kiselev's 1984 radio controlled ornithopter. Like Spencer's ornithopters, it predated the OS contest, and was unknown to Society members for many years. We have come a long way in uncovering the history of unpublicized ornithopter work and in building a wider global network of ornithopter enthusiasts. The incredible advancements Sean Kinkade has made in the last few years, from his reliable radio controlled ornithopter kit that has made hundreds of flights, to meeting the challenge of the ROG ornithopter, rank him as one of the great innovators in the field.