Flying with Canards

Text and photography by Divan Muller

Aircraft with canards, especially civil aircraft types, certainly look unconventional, or perhaps even somewhat futuristic. Elevators appear to be in the 'wrong' place, making the average passenger wonder if aircraft with a somewhat 'back-to-front' layout are safe. Ironically, aircraft with canards have been around longer than one might think.

Santos-Dumont 15-bis

North American Valkyrie - NASA

The History of Canards

The term 'canard' is French for 'duck.' It was first used in an aeronautical sense in 1906 to describe the appearance of the Santos-Dumont 15-bis biplane. Appropriately, this Brazilian-designed aircraft relied on canards to control its pitch. However, the use of canards dates back to 1903, when Wright brothers opted to use canards as control surfaces on their Wright Flyer, the world's very first successful powered aircraft.

Over the next decades, as technology changed, canards became less common, but were still used on several notable aircraft. During World War II, experimental fighters such as the American Curtiss-Wright XP-55 Ascender, Italian Ambrosini SS.4, British Miles M.35 Libellula and the Japanese Kyushu J7W all used canards. These retro-futuristic aircraft would perhaps have seemed more at home in the 2004 movie 'Skycaptain and the World of Tomorrow', but proved that there was potential in designing an aircraft with an engine in the rear and canards in the front.

Combat aircraft

In 1967, canards were used for the first time on a mass-produced aircraft, the legendary Swedish Saab Viggen. With the Viggen, canards served as vortex generators for the main wings, which resulted in extra lift. At high speeds, they also improved roll stability. These canards also had flaps which were lowered to produce extra lift during take-offs and landings. Meanwhile, in the USA, the North American XB-70 Valkyrie, with its large and distinctive canards, made news headlines and broke speed records. During one particular flight, a Valkyrie sustained supersonic flight for 74 minutes, of which 50 minutes were flown at a speed exceeding Mach 2. This experimental supersonic bomber's canards had an area of 38.7 m^2, were 'all-moving' and had trailing edge flaps.

Main photograph: Cozy Mk.IV / AeroCanard SB

Eurofighter Typhoons - Eurofighter.com

Some Mirage III variants, such as the Israeli Kfir and South Africa's own Cheetah, used non-moving canards to improve manoeuvrability and low speed handling.

However, the introduction of digital fly-by-wire control systems opened up a world of possibilities for aircraft designers. Modern fighters such as the Saab Gripen, Dassault Rafale, Eurofighter Typhoon and Chengdu J-10 use sophisticated software to control 'all-moving' canards, resulting in significant benefits in manoeuvrability.

Burt Rutan's Designs

Inspired by the Saab Viggen, well-known American aircraft designer and engineer Burt Rutan began work on a tandem two-seater homebuilt aircraft in 1968. The VariViggen, as he named it, had a delta wing and canards. It was powered by a 150 hp Lycoming engine, which drove a propeller in a pusher configuration. With this design, Rutan intended to build an aircraft with a resistance to stalls and spins. He sold dozens of plans and about twenty examples were built.

Rutan used the experience he had gained with the VariViggen to develop the VariEze, which first flew in 1975. His brother, Dick Rutan, flew the aircraft to Oshkosh that year, setting a distance record of more than 2 600 km with an aircraft weighing less than 500 kg. The aircraft caused quite a stir at Oshkosh, so Rutan redesigned the VariEze in such a way that plans could be sold to interested homebuilders. In the end, more than 400 examples were built.

An interesting feature of the VariEze, as well as succeeding variants, was the fact that its handbrake was replaced with a retracting nose

Mazda rotary engine


Barend and Sarie de Beer

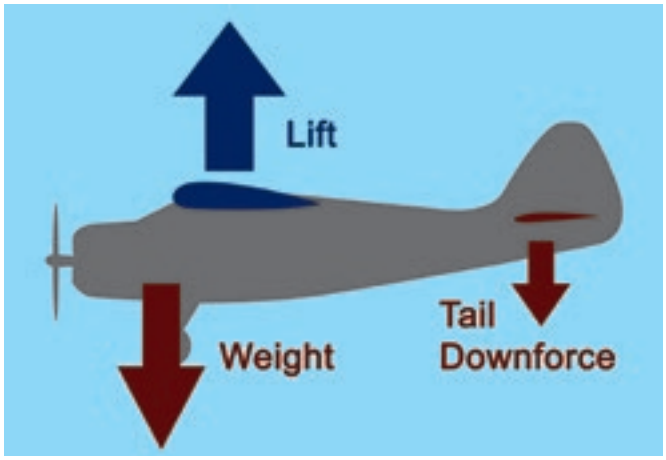
wheel. With the aircraft's nose resting on the ground, it was easier to climb into and out of the cockpit. This also moved the centre of gravity forward, preventing the aircraft from tipping backwards onto its rear whilst empty.

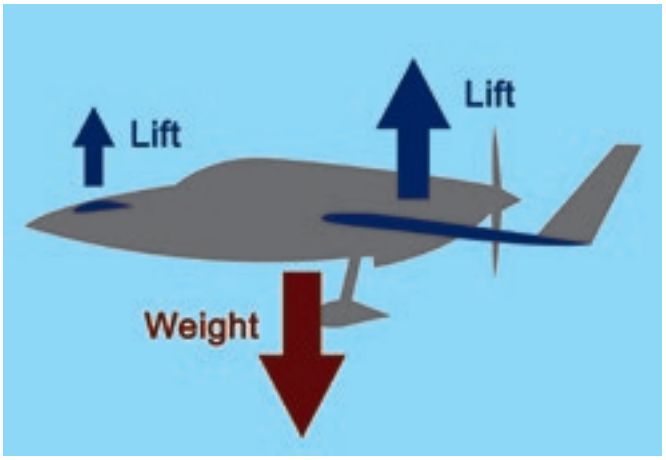
In 1979, Rutan introduced a refined version of his previous two designs. This aircraft, the Long EZ, set various world distance and endurance records, as well as an altitude record of more than 35 000 ft. In 1997, Dick Rutan and South African-born test pilot Mike Melville flew two Long EZs round the world. Commercially, as a 'plans built' aircraft, the Long EZ became tremendously successful. Over the years, several similar-looking aircraft, based on the Long EZ, have entered the market with various modifications and improvements. These include the Cozy range of aircraft, most notably the four-seat Cozy Mk.IV. Meanwhile, AeroCad Inc. also made its range of AeroCanard aircraft available, each with its own unique features.

Specifications

Aircraft	Long EZ	AeroCanard	Cozy Mk.IV
Engine power:	115 hp	180-200 hp	180 hp
Cruise speed:	160 kts	180-210 kts	200 kts
Climb rate:	1 750 ft/min	1200 ft/min	1 300 ft/min
Range:	3 200 km	1 800 km	2 400 km
Service ceiling:	27 000 ft	25 000 ft	20 000 kg
Empty weight:	322 kg	520 kg	476 kg
Useful load:	280 kg	410-450 kg	450 kg
Height:	2.4 m	2.4 m	2.4 m
Length:	5.1 m	5.1 m	5.1 m
Wingspan:	8 m	8.6 m	8.6 m
Seats:	1-2	4	4


MGL' iEFIS avionics





AeroCanards are available in four variants:

FG - Fixed main gear and retractable nose wheel. Electrically operated nose wheel and airbrake.
RG - Similar to FG. Retractable gear.
SX - Similar to FG. Different windscreen and round side windows.
SB - Smaller body. All parts interchangeable with Cozy Mk.IV.

Aero Canard Southern Africa

In October 2011, South African aviation enthusiasts Barend and Sarie de Beer purchased plans for a Cozy Mk.IV from a company in the USA. In Barend's words, "There are approximately 300 Cozy Mk.IVs in the world, with our aircraft being one of four Cozys built in South Africa. The unique safety features, excellent performance figures, four seats and futuristic looks of the Cozy convinced us that this was the only aircraft for us."

As we know, wings provide lift, but with most conventional aircraft, the centre of gravity is forward of the centre of lift, so a horizontal stabiliser in the rear is necessary to balance the aircraft by producing 'tail downforce'. This prevents the aircraft from pitching its nose down. As a side effect, the aircraft's wings have to produce even more lift, to counter 'tail downforce', in addiction to the aircraft's weight. Aircraft with canards behave differently. Unlike horizontal stabilisers, canards produce lift. This means that the wing is required to produce less lift than the wing of an aircraft with a conventional layout.

When Barend and his wife made the decision to build their own aircraft, these factors helped them choose the Cozy.

"Unlike a conventional aircraft, the Cozy will not stall mid-flight. Instead, it automatically lowers its nose and flies faster if the plane


Raising the nose by lowering the nose wheel


Cozy Mk.IV Canards

is being flown too slowly. This immediately eliminates one of the primary reasons of a potential accident," said Barend.

During the construction process, Barend was impressed by the way the aircraft had been designed. "We realised the exceptional design, safety standards and performance of this aircraft and decided to explore the possibilities of marketing and selling this amazing aircraft in the Southern African region. We made contact with AeroCanard in the USA, which produces various plans and kit options for the AeroCanard aircraft range, which are derivatives of the Cozy MK.IV."

He continued, "Aero Canard awarded the agency for the southern African region to us and we will now be able to offer several options, as well as technical support from an approved aircraft maintenance organisation (AMO) at Wonderboom Airport, to future builders. These options will suit any potential builder's budget and technical ability. With the 'quick build' support programme, a customer could be in the air with his or her new AeroCanard in less than six months."

The De Beers' Cozy is powered by a turbocharged rotary engine, but Barend recommends the UL520iS for kits supported by his company, Aero Canard Southern Africa. Unlike his rotary engine, the UL520iS was designed specifically for aircraft and results in improved performance.

In terms of flight, engine and navigation instruments, the De Beers have installed MGL Avionics' iEFIS (Electronic Flight Instrument System). This glass cockpit solution is perfectly suited for high performance touring aircraft, such as the Cozy Mk.IV and AeroCanard range of aircraft.

Services and products

The following services and products are offered by Aero Canard Southern Africa:

- Plans, kits, raw materials and parts for the AeroCanard range of aircraft.
- Technical support and maintenance service for the AeroCanard range, including:
  - Coordinating financing and insurance
  - Administrating the customer's 'build budget'
  - Providing the plans and drawings
  - Providing the 'quick build' aircraft kits
  - Administrating the allocation of build numbers
  - Managing the registration of aircraft with the SA Civil Aviation Authority
  - Coordinating builder attendance and training
  - Liaising and coordinating the purchasing of buy-in items
  - Coordinating the flight test programme
- Quick Built support programme includes:
  - Providing equipment and labour for unpacking kits from shipping containers
  - Providing space for storage and construction of each aircraft
  - Providing required tools
  - Arranging for inspection and sign-off of aircraft or assemblies as construction progresses
  - Arranging for and coordinating normal and sub-contracted work (e.g. installation and integration of avionics and electrical components)
  - Keeping documentation for each aircraft updated throughout the construction process

For further information, please contact Barend de Beer at 071 305 5752 or visit www.aerocanard.co.za