CIAM Flyer

Annual Report 2010

FAI AEROMODELLING COMMISSION

The Multifaceted World of Aeromodelling

CIAM Flyers provide an insight

The CIAM Flyer aims to give interested young and old people an understanding of aeromodelling. Those working in the media can use it to gain an impression of the diversity of the sport. Most aeromodellers – and those that compete most of all – focus on only one or a few aspects or categories of model flying. The CIAM Flyer helps them to find out about other aspects. The CIAM Flyer does not strive to be a specialised technical publication but aims to provide as much varied information, stimulation and motivation as possible.

2010 again saw 6 issues being produced, for which I received generous support and advice from Subcommittee Chairmen and other CIAM Bureau colleagues. Thank you.

In order to continue producing an issue every two months, we need assistance from the large community of aeromodellers. It doesn't take all that much: an idea, a brief report or story and some good images. Who will help?

Many thanks in advance and kind regards,

Emil Ch. Giezendanner

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No. 1-2010

Sopwith Schneider 1915

Gordon Bennett Trophy 1909

The Obsession with Flying the World's Fastest Aeroplane

Air Races in the Past 100 Years – Also Attractive in Model Flying

The first prestigious international air racing competition mentioned in aviation history is the Gordon Bennet Trophy which was first held in 1909. In aeromodelling, international races have been taking place for more than 50 years. They too require maximum concentration and steering ability from the pilot.

A Multitude of Air Races Followed

The air race named after its sponsor, James Gordon Bennet, for the Gordon Bennet Trophy first took place outside Reims, France from 22nd to 29th August 1909 and was won by Glenn Curtiss. Louis Blériot came second. A large number of air races subsequently emerged in the US, England, France and Italy. One of these deserves to be specially mentioned – the Coupe d'Aviation Maritime Jacques Schneider, founded by Jacques Schneider (FRA). The competition was restricted to seaplanes and airplanes equipped with floats. The first race for the Coupe Schneider was held in 1913 by Monaco harbour.

The ten kilometre race course in Monaco consisted of four straights and had to be circumnavigated 28 times. The shortest distance was only 200 m, requiring very tight cornering. The cup was won by Frenchman Maurice Prévost with an average speed of 73,56 km/h.

Air Races with Control Line Models

The first air races with model aeroplanes were probably held towards the end of the World War II and used models held and controlled by wires ("Control Line Speed", now the competition class F2A) on a circular course. Today, the circle radius is 17.69 m so that nine laps equal a distance of one kilometre. Whoever covers this distance in the shortest time has flown with the highest average speed and thus won the race. Speed World Championships are said to have first been mentioned in the FAI Sporting Calendar in 1953. The world's fastest Open Control Line speeds are currently 340 km/h.

Typical modern Control Line Speed Model Airplane (FAI Class F2B)

Establishing the Triangular Course

In 1920 and 1921 the FAI delegated hosting of the Coupe Schneider to the royal Aero Club of Italy. The race was held over Venice's Lido – with sea planes, as in the founding period – and on a triangular course for the first time. The unequal sides of the triangle had a length of 24.74 km, 11.4 km and 13.86 km, resulting in a circumference of 50 km or 27.07 nautical miles. In 1920, the competition was won by Lieutenant Luigi Bologna, Italy on a Savoia S.12 with 170.54 km/h and in 1921 by Giovanni de Briganti, Italy with 189.66 km/h on Macchi M.7

Radio Control on the Triangular Course

The introduction of radio control systems in the 1950s did not initially lead to the development of racing models, as model pilots at the time were more keen to have benign and inherently stable motorised and glider models that they could steer back to the ground in one piece. This is likely to be one of the reasons why the first international competitions with RC aircraft were limited to flying simple manoeuvres such as loops, turns and rolls (the first FAI World Championships in RC aerobatics were held exactly 50 years ago in Dübendorf, Switzerland). However, the desire for faster planes increased with the technical improvements of RC systems and engines. As early as 1972, the CIAM created the Pylon Racing Category (F3D) for radio controlled racing models – the first World Championships, however were not held until more than ten years later, in 1985 in the U.S.A. with 18 competitors from six countries taking part. As in the Coupe Schneider, mentioned earlier, the race is around a triangular course. The isosceles triangle (2 x 180 m and 40 m) with a circumference of 400 m has to be circumnavigated ten times. At the World Championships, the leaders cover these 4 km in 57 sec, corresponding to an average speed of 280 km/h. Since 1994, air races, which were previously restricted to combustion engine categories only, have also been possible for Electric Pylon Racing Models (F5D). This was when the first FAI World Championships were held in Wangaratta, Australia. Today, these electric powered racing models have also seen tremendous technical development and are as fast as their combustion engine counterparts. However, the Electric Pylon Racing Models are not equipped with landing gear and are launched by hand.

Pylon Racing (F3D) FAI World Championships 2009 in Germany. See http://www.fai.org/aeromodelling

Photographs: Gerhard Wöbbeking and Bob Petrie.

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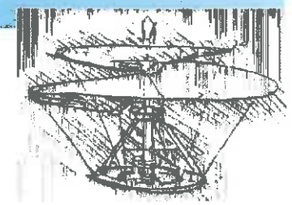


Helicopters - Complex Technology Takes Longer

Functional principle and technology of helicopters are fairly complex. It's no coincidence that flight trials with helicopter-like aircraft were conducted over a number of decades, with the main developments taking place sometime between 1935 and 1950. The term "Helicopter" originates from the Greek "helix" (= spiral) and "pterion" (= wing). Looking at Leonardo da Vinci's initial studies from around 1483, the relationship with a spiral is easily seen.

First helicopter of Paul Cornu 1907

Igor Sikorsky 1942

A Short History of the Helicopter

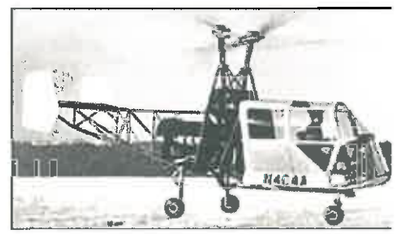
Paul Cornu is now recognised as the inventor of the first helicopter. It is reported that the bicycle manufacturer, born in 1881 in Lisieux, France, successfully achieved the first helicopter free flight with a hovering height of 1.5 m as early as 1907. The aircraft was equipped with two rotors and was powered by a 24 hp Antoinette engine. Flights – some even with a passenger – apparently lasted for 60 seconds and reached speeds of up to 11 km/h.

About 30 years later, the Focke-Wulf Fw 61 was presented in Berlin. This aircraft, that was also twin rotored, was the first that could be accurately steered and hover in one place.

Focke-Wulf Fw 61 1937

One of the possibly greatest helicopter pioneers is undoubtedly Igor Sikorsky, born 1889 in Kiev. The aircraft designer emigrated to France in 1917 and later to the US, where he was awarded a government contract to develop a helicopter. Various trials finally resulted in a design with one main rotor and a vertically positioned tail rotor which is still the most common design today. This made Sikorsky the first designer to succeed in building a helicopter with a single rotor. The R-4 was handed over to the US Army on 18th May 1942, following a flight of 760 miles in 16 hours.

The first turbine-powered helicopter was Kaman's K-225 (H-22). It was derived from the piston engine version – which was already being successfully used by the US Navy – and fitted with a Boeing 502 Turbine in 1951.



K-225 with a gas turbine

Radio Controlled Model Helicopters Came Later

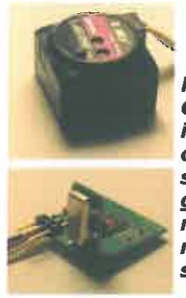
It was not until 20 years later that the era of radio controlled model helicopters (or RC helicopters) began. The German Dieter Schlüter is inextricably linked with this development. As a trained car mechanic and later engineer, he started initial trials and flights of a few seconds in 1968.

Bell Huey Cobra de Schluter

His breakthrough came with the Bell Huey Cobra in Harsewinkel at Whitsuntide 1970. This was the trigger for an unimagined worldwide boom for model helicopters. Initially, pilots mostly practised hovering and neat circular flights. With increasing technical perfection of the rotor heads, their linkage and control, increasingly precise flights became possible. The desire to measure the technical capabilities of one's helicopter as well as one's flying skills against those of others soon led to the first competitions. 1985 saw the first FAI RC Helicopter World Championships with 37 competitors from 17 countries being held in Canada.

The Gyro – a Small Miracle

The "gyro" consists of a sensor and a microcomputer. The sensor registers even the smallest positional changes of the helicopter tail and corrects these through computer commands to the tail servo. This does not, of course, include commands given by the pilot through the RC remote control. The tail servo is nothing other than a tiny electric motor that mechanically alters the tail rotor blade pitch and thereby keeps the helicopter facing in the desired direction. This small electronic device makes flying radio controlled helicopters a lot easier. The latest electronic devices for model helicopters go even further and include three or more such sensors. They can keep the helicopter in the air more or less independently, however, only one sensor acting on the tail rotor is permitted in championships.



Heading-hold Gyro from the inside and the outside. The silver rectangular component is the rotation sensor itself

Aerobatics with RC-Helicopters – the Big Challenge

Today's generation of model helicopters lets practised pilots perform the most extreme flight manoeuvres that would have been unimaginable just a few years ago, such as loops and rolls, somersaults, inverted flight, unpowered, so called auto-rotation landings and many more. FAI World Championships for RC helicopters (Category F3C) require the completion of fixed routines. Then there are 3D events with even more complex manoeuvres as well as freestyle events with undefined routines, usually flown to music. The F3C

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World Championships has grown to 74 competitors of 25 countries. More detailed information about RC helicopter competitions can be found under www.fai.org/aeromodelling/documents

Making Things Easier for Beginners

Whereas 25 years ago, getting started with flying helicopters required many hours of practise and often several spare parts, huge technical improvements have made learning to fly a helicopter siginificantly easier. There are PC simulation programmes that let you practise flying helicopters with amazing reality. Then there are coaxial helicopters, autopilots, etc.

Technology Never Stands Still

In early 2000, electric propulsion conquered virtually all model flying categories and established itself particularly well for RC helicopters. In the last few years, gas turbines have also been used to power model helicopters. However, this rather complex technology requires high levels of skill and experience. The reward is a very realistic flying aspect along with the scent of the big wide world – of kerosine.

RC helicopter with gas turbine

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Top Performance with Limited Amounts of Energy

Motor of the Graupner Silentius was the Faulhaber Micro T03 with 1 : 15 gear.

1971: Fred Militky and Wolfgang Schwarze demonstrated the RC model „Silencer" at the F3A World Championships in Doylstown, USA.

Electric Flight World Championships on a Level Playing Field

Huge power increases in electric model aircraft propulsion in the last few years have caused the relevant subcommittee of the International Aeromodelling Commission of the FAI to once again impose power limits in electric flight competition categories – mainly for safety reasons.

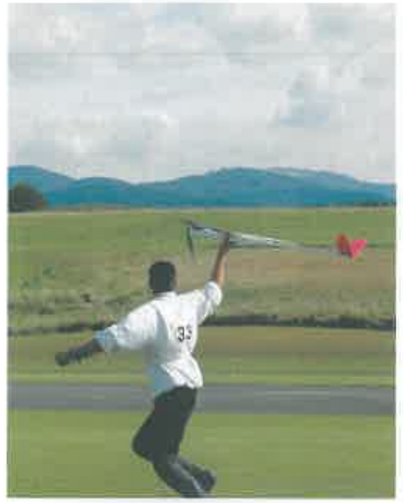
In the Beginning they Could Barely Remain Airborne

Fred Militky began developing his first electric powered model aircraft in the 1950s and the company Johannes Graupner employed him in 1956 to develop model aircraft. He achieved his breakthrough as early as 1959 with the electric free-flight model FM248 which was able to remain airborne for 23 minutes. The model – with further improvements – was then launched by Graupner in 1960 as a kit called „Silentius". Three years later, Militky achieved a successful trial with a radio-controlled electric model plane. The big breakthrough came in 1971, when Fred Militky and Wolfgang Schwarze demonstrated the RC model „Silencer" to an astounded audience at the F3A World Championships in Doylstown, USA. First electric flight competitions were held as early as 1973 – among them the Militky Cup in Switzerland.

Silentius, electric powered freeflight model airplane of Fred Militky. This was a Graupner kit 1960.

Power Increase through Competition

The now emerging competition scene led to a tremendous optimisation of electric propulsion power. At the first World Championships for electric model gliders 1986 in Lommel, Belgium, large aircraft with wing spans of 3 m were used. Their power was delivered by battery packs of 30 to 60 NiCad cells weighing approx. 1.5 kg. Only two years later models thus equipped, climbing at a rate of about 20 m/s, could disappear from sight within just a few seconds thus increasingly causing safety concerns. The international committee therefore began limiting the power on model gliders in several stages. It was not long before the number of cells and battery pack weight were reduced.



Launching of an electric motorglider at competition

The Battle of Batteries

Limits on weight and/or cell number made competitors go to great lengths to select the best and most lightweight NiCad and later NiMH batteries. Cells were selected not only for weight and discharge characteristics, each individual cell was additionally activated or "pushed" with current impulses. When pushing a NiCad cell, a very high current has to flow for a very short time. This huge current changes the crystal structure of the electrode causing a reduction of the cell's internal resistance which, in turn, allows very high currents to be drawn during flight.

Battery pack of 16 NiMH cells as standard power source for the electric powered glider class before 2008

Although this made tremendous performance possible – electric model gliders achieved climb rates of 50 m per second and more – battery life was greatly reduced. Cells were overloaded and would get very hot, often causing them to explode. Whoever was able to obtain the most cells would have the most powerful propulsion. The "Battle of the Batteries" had begun.

Folding propeller of an electric powered motor glider

Common Sense Prevailed

More and more competitors were fed up with the huge expenditure for batteries. The recruitment and support of young enthusiasts also became nearly impossible. The responsible body knew that the path taken so far would inevitably lead to a dead end. Limits on weight and size of batteries, current limits, limits of engine running time or regulations for motors were not being considered. It was much more elegant to limit the amount of energy used.

Example of a small instrument, weighing only several grammes, that can be used to determine the energy at which the motor automatically shuts down

Multiplying voltage, current and time yields electric energy. The unit for electrical energy in physics is Joule (Watt-second Ws) and when measuring energy consumption in electric power engineering, Kilowatt-hours kWh is commonly used. For electric model flying, Watt * minutes have proved very practical and for F5B Electric Gliders 1750 Watt-min are available per flight and 1000 Watt-min for F5D Pylon Racing models. Once the energy is used up, the motor shuts down. This requires sophisticated tactical behaviour from competitors. Somewhat simplified, they may decide, when gliding, to cover as many laps as possible with very high power but then have no energy reserves left for continuous flying. Depending on meteorological conditions, such decisions may have to be made at very short notice. Limiting power also increases battery life. This rule has turned the battle of the batteries into a competition of efficient energy use combined with tactical and flying skills.

Sensor for current measurement

Motor with speed controller and the (red) sensor for the current on the right

FAI European Champion 2009 in the electric powered glider class F5B Reno Frattini, Italy. He won with limited emounts of energy

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Concentration is Crucial in Aeromodelling

If you are building and flying model aircraft, you have to concentrate. Highly detailed craftsmanship, complex technical assembly work and accurate flying require in-depth involvement. The realisation that concentration is the best aid for rest and relaxation is by no means new.

High Everyday Stress in our Modern World

In industrial countries, young and old are subjected to increasing physical and mental stress through school, work and enormous floods of information. An ever changing environment also increases the tendency to experience symptoms of stress, burnout and illnesses, often leading to increased accident proneness. Young people are complaining of a lack of ability to concentrate. This has a negative effect on their performance at school, in turn causing stress for parents ....

Various Techniques for Relaxation

It is a common misconception that consuming information is a way to relax. To be exposed to a constant stream of images and sound in front of a screen does not reduce our brain's activity and therefore does not let us relax. Everyone has to find the relaxation technique that suits them best. Other than known methods such as autogenic training, yoga or other meditation exercises, various types of creative design, listening to music and physical exercise can have an excellent effect.

Building Your Own Models

Using one's hands to work with wood and other materials not only provides excellent training of fine and gross motor skills but also helps to identify abilities and boundaries. The concentration required for much of the building and assembly work on a model aircraft helps to quickly forget everyday stress.

Precise technical work with various materials – excellent training for young people

A successfully finished job – a completed model aircraft that even flies – gives the builder pride and confidence. Aeromodellers who are committed to building true-to-scale replicas of full-size aircraft – this category of aeromodelling is called "Scale" - pay Painstaking attention to

detail and spend months and years to successfully complete a model. Whoever has a look at these Scale models during a competition will soon realise that they are true works of art. Rest and relaxation through concentrated and creative work is also recognised by experts in the medical field.

Highly accurate details on a scale model

Flying as a Challenge

The second part of aeromodelling is flying itself. Every respectable flying machine needs subtle adjustments and careful flying-in. Launching models that are required to glide for as long as possible and cannot be influenced by radio control while flying, requires maximum concentration. In addition, the weather situation and air currents have to be closely monitored. Radio-controlled motor and glider planes and helicopters must be constantly watched and assessed. Flight aspect and flight path are influenced by subtle movements of the fingers on the transmitter's control stick. If your goal is to fly clearly defined routes and figures or to master model aircraft at high speeds, you need regular training as well as enormous concentration during flights. These are crucial requirements for e.g. aerobatics with RC or control-line models and helicopters as well as RC glider championships. Of course, a clean landing is also a challenge.

Maximum concentration when launching a free-flight motor model (F1C). Photo: M. Dilly

Powered launch with winch at an F3B glider competition

Quick reactions and training for aerobatics with control-line models: sometimes as low as 1.5 m above the ground

AeroMusicals: Maximum control of a radio-controlled aerobatic indoor model

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Remembering the Birth of Aerobatics World Championships for Radio Controlled Engine Powered Models

50 years ago, on the weekend of 23rd and 24th July 1960, the very first FAI World Championships for radio controlled aerobatics models were held on the airfield in Dübendorf, Switzerland. They were organised by the Aero Club of Switzerland and spectators were fascinated by the 20 competitors from eight countries competing in sometimes stormy conditions.

Ed Kazmirski, the first RC Aerobatic World Champion

The World Champion standing in front of about 20 photographers as he brings his winning "Orion" model in to land

Only Models Built by the Competitor

The rules explicitly required the aeroplane to have been built by the pilot. The engine and the RC system were exempt from this requirement. The main construction materials used were balsa and plywood as well as silk, paper and stiffening varnish. The average flying weight is said to have been between 2 and 3.5 kg. The models were smaller and much lighter than those of today and all three types were represented: low-wing and high-wing planes and even one biplane. The latter was the much admired De Bolt Bipe, owned by Eliasson from Sweden, that unfortunately did not make it off the ground. There was a remarkably broad range of engine cylinder sizes – from 2.47 ccm (MVVS) to 9.7 ccm (Ruppert).

Rebuilt "Orion" the model aircraft of the first World Champion was an exemplary aerobatic model airplane for years

Ruppert engine used by most of European competitors

Storm Winds and Numerous Crashes

On Saturday, a stormy and unsteady westerly wind was blowing over the former home airport of Swissair in Dübendorf. It is unclear whether these difficult conditions were responsible for the crash of German Hans Gast's model. De Bolt, USA and Corghi, Italy had the same bad luck. Their beautiful models shattered on a grassy field. Both blamed faults in the RC connection. Apparently, after each crash, spectators immediately crowded around the debris and a swarm of journalists wanted to have a close-up look at the scene of the accident. De Bolt was relaxed about it all – he had a spare model with him – and let the boys take parts of his crashed aircraft home as souvenirs.

Unlucky Hans Gast, GER crashed his "Smog Hog" into the runway

Rebuilt "Caravelle" of Gustav Saemann, GER 2nd place

Since 1960 the Trophy of the Belgian King is the RC-Aerobatic World Championships Trophy showed with the current World Champion Christoph Paysan Le Roux, FRA.

Very Different RC Control Systems

Unlike RC Aerobatics World Championships today, the RC systems used varied significantly. Five competitors are said to have built their own control systems – this should include those by Stegmaier and Nievergeld which used vacuum to move the control surfaces. The highly sophisticated Stegmaier control system received much recognition at various European competitions and the Orbit RC system was at a very professional level. The servos didn't look much different from today's larger types.

Swedish competitor Eliasson was not very successfull with his De Bolt "Bipe"

Swiss Competitor Fredy Bickels original aerobatic model airplane of 1960 World Championships

Significant Public Interest

These first RC Aerobatics World Championships were apparently perfectly organised. Arnold Degen of the Swiss Aero Club as competition leader and site speaker Hans Waeffler, with his technically sound commentary, was able to fill the audience – up to 8,000 spectators are said to have turned up – with enthusiasm. Chief press officer Werner Koelliker managed to mobilise various major daily newspapers, which led to a mainly positive media response. But even then, the question of safety was an issue. One large Zürich daily paper wrote: "However, the serious question remains, whether radio controlled model flying in its present development phase is sufficiently safe to justify the involvement of a large audience".

Photos: Amercan Modeler 1961 and Hermann Mettler
Text: Based on an interview with Werner Koelliker

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Ingeniously simple mechanical system

The mechanical system of the microcopter is ingeniously simple: absolutely nothing rotates apart from the rotors! Therefore a light crash on grass usually means only the rotors have to be replaced. The quadrocopter, for example, consists of the following components: a flight control card with the main control system, four cards with brushless motor controllers, four brushless motors including propellers, frames and various parts such as receiver, battery, canopy etc. Whereas on a helicopter the trail provides torque compensation, on the quadrocopter there is one opposing pair of rotors rotating in one direction while the rotors of the other axis rotate in the opposite direction. When all four rotors are rotating at exactly the same speed and creating an amount of lift that corresponds to the aircraft's weight, the result is a stable hovering state. To make it move, it has to be brought out of this static state, which is achieved by varying the rotor speeds.

Kit of a quadrocopter

Highly complex electronics

One problem is that total thrust has to be maintained, even when the speeds of individual rotors are varied by operator intervention. In order not to make things too difficult for the pilot, electronic control of the flight attitude is vital. To this end, designers have provided the system with gyro sensors and accelerations sensors for all three axes. A control system performs 500 analyses of this data every second and uses this to calculate drive for the motors. All sensors required for flying are located on the flight control card. Integrated air pressure sensors are not really required for the basic functions, but act like a selectable restricting "roof": Once the microcopter has reached a desired altitude, a switch on the remote control can be used to select this as a set value. The aircraft maintains this altitude even when power is increased. The air pressure sensors are extremely sensitive and can detect altitude with remarkable accuracy.

Like a helicopter, the aircraft is controlled using four functions

Pitch, roll and yaw

Like a helicopter, the aircraft is controlled using four functions: yaw, pitch, roll and throttle. The following can help fixed wing pilots to remember them: the "yaw" function is something like the rudder and determines horizontal alignment of the aircraft, "pitch" roughly corresponds to the elevator and "roll" to the aileron. The flight attitude control also acts to always return the aircraft to a stable, horizontal state when all joysticks are released. This is ideal for novices. If, however, you want a lively and agile chopper suitable for aerobatics, you can select the "heading hold" function and the otherwise compulsory stabilisation in the horizontal plane is eliminated.

Options

A variety of accessories are available to complement the microcopters' basic equipment. A compass module, for example, will hold the microcopter in the direction it was last steered in when all controls are released. GPS modules let the pilot virtually "nail" the microcopter to one position. The selectable "coming home" function makes it automatically return to its take-off location. It can also fly to successive waypoints, previously entered on the PC via coordinates or aerial images. To make sure that these aircraft are not considered to be a "military danger", manufacturers limit their range to around 250 metres. It is even possible for a microcopter to follow a moving object on the ground. The object on the ground has to be equipped with a GPS receiver and transmit position data to the aircraft.

Microcopter in the night

Microcopters are predestined to be load carriers for still and film cameras. High-tech mountings can even compensate for pitch movements and keep the camera perfectly still. Of course, flying with video glasses is of enormous interest here. With a data connection to the flying microcopter, details such as altitude, orientation, and velocity of the aircraft can be controlled from the ground using a laptop computer.

Summery of the story "Ich schwebe" of H. J. Baum, Zurich 2010

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