



Associazione Italiana per la Radio d'Epoca

Historical re-enactment of the first radiotelegraphic transmission between air and ground carried out by Guglielmo Marconi in September 1915

Event organized by the members of the AIRE Piemonte "Italian Association for Vintage Radio" <http://www.airepiemonte.org/orbassano.html>

History

May 1915, Italy enters the war; Guglielmo Marconi is enlisted with the rank of Second Lieutenant of the first Regiment of Dirigibles.

The war in that period took place with completely different techniques than today. The artillery landed the blows in the direction of the enemy; the observers, staying on high grounds or on dragster balloons as observation points, were informing by telephone the artillery command and providing useful information to better direct the blows on the enemy.

The airplane had entered the military field since a couple of years yet it was immediately recognized as an important means of air warfare.

The military leaders also understood its potential to direct artillery fire. For this purpose, they commissioned Guglielmo Marconi to create a wireless telegraphy system to be installed on an aircraft in order to connect it with the departments at ground.

Guglielmo Marconi accepted the challenge; at the old pier in Genoa he had his OFFICINA MARCONI where the first prototype was built. It was a spark transmitter, with a power of about 30 Watt, powered by batteries, enclosed in a small wooden box weighing 16 kg.

When the transmitter was finished, it got presented to the military authorities present at the Mirafiori airfield close to Torino on a day in September 1915.

We come now to the important day, actually quite improvised.

The only two-seater plane present on the field was a Caudron G-3 biplane (Photo N° 1) built in the AER workshop in Orbassano close to Torino (Photo N° 2), its pilot Corporal De Marco (Photo N° 3) had not yet completed the training to obtain the pilot's license.

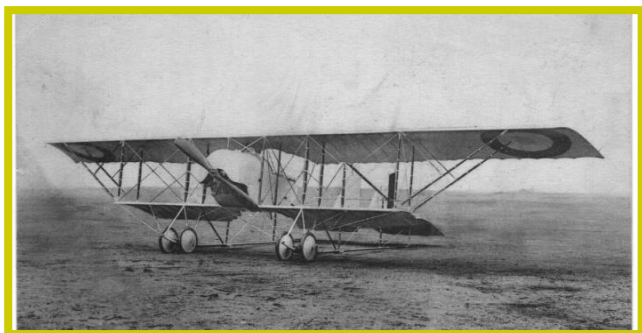


Photo N° 1 Biplane Caudron G-3



Photo N° 2 what remains of the AER plant in Orbassano



Photo N° 3 Caudron G-3 and Corporal De Marco at Mirafiori Airfield



Guglielmo Marconi and Corporal De Marco

There was no telegraph operator and then Marquis Solari, Marconi's collaborator, offered himself.

A small field station was set up on the ground. When everything was ready, Marconi, General Moris and some officers of the Military Engineers approached the plane. Marquis Solari placed the batteries on the floor of the plane and the transmitter between his legs.

The antenna consisted of a copper wire about 25 meters long dropped outside the cabin after take-off, while the earth was connected to those small metal parts of the biplane's frame.

The biplane took off and flew over the Mirafiori airfield, moving towards Mont Cenis and then reversing its course; the Morse transmission, limited to the letters SSS followed by the letters VVV, was always heard from the ground receiver managed by Marconi.

The day was rather windy, the small biplane had strong jolts that put to test the Marquis Solari.

The landing was then even worse, the impractical pilot had the aircraft tilting three times, resulting to a broken wing due to lateral landing but fortunately without damage to the pilot and the telegraph operator.

The experiment could be considered concluded in a positive way; on that day the radio had officially occupied an important role on board of airplanes. The prototype was then perfected and the subject of a subsequent field-test in November 1915. It was subsequently produced on an industrial scale and given its small size it was nicknamed Marconcina (little Marconi).

In the following months these transmitters were mounted on various aircraft and used with excellent results to direct artillery fire.

However, these boxes that produced sparks were viewed with distrust by pilots for adding additional weight on board and because, in environments with the presence of gasoline vapours, they were a great danger for fires and explosions.

It is interesting to know that only the transmitter was present on board of the aircraft; the receiver, due to the noise of the air moved by the propeller, the noise of the engine and the electrical disturbances produced by the engine start, could not work. The pilot received the service orders through white sheets, placed on ground by the military to form various figures according to an agreed code.

Initially when these transmission systems were installed there were not enough radio telegraphers trained to operate using morse code. The obstacle was circumvented by using a series of points and lines according to an agreed code, for example 5 lines meant lengthening the shot, 5 points shortening the shot, and then 3 lines and 3 points to shoot to the right and so on.

It will then have to wait until the end of the First World War, at the beginning of the 1920s, when, thanks to the advent of thermionic valves, the aircraft were equipped with efficient transmission and reception systems, free from potential dangers for the pilot and for the aircraft.

At the end of the First World War, the Mirafiori airfield was named after the second lieutenant "Gino Lisa", gold medal for memory military valour. Currently this airport no longer exists as in 1947 it was decommissioned and incorporated in the development of the city of Torino.

Even the Caudron G-3 biplanes that were built by the AER plant in Orbassano at the rate of 1.000 aircraft in 1.000 days are no longer available.

Let's now talk about the historical re-enactment

I think it was the month of December 2020; I don't remember exactly on what occasion, but I do remember that our AIRE President Andrea Ferrero spoke of a historical re-enactment to come. I listened better, it was the re-enactment of the first radio transmission from a Caudron G-3 aircraft made by Marconi in September 1915.

But "where are we going to get a Caudron G-3?" I asked.

Andrea in a calm but firm tone said that a Tiger Moth biplane was available, perfectly similar to the Caudron G-3 **and this is really true !!**

We began to fantasize and think about how to organize the event, in particular which devices to use, how to build the transmitting and receiving antenna, how to bring the transmitter on board and a thousand other things.

I think to remember that on looking around that day I saw no one enthusiastic about being an aviator telegraph operator. I thought, if it was possible to fill this role, I could satisfy all my passions in a single manifestation:

- ✓ Participate in the re-enactment of a historical event highly connected to the history of radio communications
- ✓ Experience the thrill of flying on a vintage biplane
- ✓ To work for the functional recovery of radio equipment rich in historical significance
- ✓ Carry out transmission tests with a spark transmitter and reception with a carborundum receiver, both original equipment of that era
- ✓ Communicate using telegraphy

I timidly made my proposal and was immediately enlisted as the on-board radio-telegraph operator.

The months to come were used for the technical and logistical organization of the re-enactment.

In practice, the field receiver would have been installed in Orbassano in the courtyard of what remains of the AER factory, while the Tiger Moth biplane with the pilot and radio-telegraph operator on board would have taken off from the Aeritalia "Edoardo Agnelli" airport in Torino,.

Equipment used

We now come to the choice of equipment; the Marconcina (Photo N° 4) <http://www.airepiemonte.org/files/Articolo-sulla-Marconcina.pdf> built by the Officine Marconi of Genoa it was undoubtedly the main actress but the receiver could not be outdone; for this reason we have chosen the Omnibus receiver <http://www.airepiemonte.org/files/Ricevitore-Omnibus.pdf> (Photo N° 5) produced by Marconi Wireless Telegraph Co Ltd in 1912.



Photo N° 4 Marconcina transmitter



Photo N° 5 Omnibus Receiver

Both devices, owned by the RAI Museum of Radio and Television in Torino, have been entrusted to us as a concession for use for the realization of the event.

From the beginning, our belief was to carry out the re-enactment using original equipment of the time on condition that they were actually functioning. After a period of 100 years and more, the difficulties encountered in making them operational were not indifferent but in any case, they were all overcome and the devices arranged to work at their best.

The Marconcina could work on a wavelength between 200 and 400 meters; in order to use smaller antennas we have chosen to work on the wavelength of 200 meters equal to 1.500 kHz.

In the Omnibus receiver the signals are detected either with a carborundum crystal or with a Fleming diode. In the 10s of the last century, technical knowledge had not yet fully demonstrated the superiority of the Fleming diode over the carborundum crystal. For this reason, both systems were installed on this receiver. In this period, what was known was the enormous economic difference between the diode and the carborundum; the diode is very expensive, the cost of carborundum is very low.

In the photographs of the time we often see the Omnibus receiver used without the Fleming diode. The carborundum crystal is efficient as the diode and this solution was the one chosen by us too.

The Fleming diode visible in the photographs of our Omnibus is a perfectly faithful but non-functional replica, made by the wizard of thermionic valves and AIRE partner Erbea Alberto.

Field tests

Now after having repaired the transmitter and the receiver, before operating on the biplane, it was necessary to verify whether the receiver was capable of detecting and listening to the signals transmitted by the Marconcina through headphones with field tests.

For this purpose we used an experimentation field <http://www.airepiemonte.org/files/Storia-di-una-Marconcina-e-di-una-gatta.pdf> located in Valsesia, in a mountain area overlooking the Monte Rosa (Photo N° 6).



Photo N° 6 the experimentation field in the valley overlooking Monte Rosa

Antennas used for tests

For the receiver we built a 50 meters long wire antenna, equal to $\frac{1}{4} \lambda$ using 1,5 mm² copper wire.

Instead, for the transmitter it was necessary to simulate an antenna similar to the one we would later use on the biplane.

In the tests of 1915, the antenna connected to the Marconcina consisted of a copper wire a few tens of meters long that protruded and dangled from the plane <http://www.airepiemonte.org/files/Sistema-di-antenna-in-uso-negli-aeroplani.pdf>, at its end a weight of about 300 grams was used to keep the antenna under tension.

For this purpose, we built another long wire this time about 25 meters long supported near the Marconcina by a 6 meter telescopic pole.

The antennas were deliberately positioned at about 90° from each other in order to verify the efficiency of the system in the most unfavourable condition.

In 1915 the Marconcina earth lead was connected to the metal structure of the biplane.

In order to simulate this earth connection quite similarly, we made a dummy earth. As for the Omnibus receiver, the earth lead was connected to a sturdy stake firmly driven into the earth near the receiver.

The tests carried out at the distance between transmitter and receiver of 350 meters allowed us to immediately listen the signal produced by Marconcina in our headphones and this was encouraging. Tests at a distance of 1.400 meters gave the same results with a slightly lower but perfectly understandable signal.



Photo N° 7 6 disc discharger all connected

La Marconcina has always worked perfectly; strong sparks were produced in the 6-disc discharger (Photo N° 7) and a current of 0,3 Ampere was reached in the antenna ammeter.

By means of the pin (Photo N° 8) it was possible to split the spark between 4, or 5, or 6 discs.

When the spark is discharged between 4 discs the note in the receiver is higher and vice versa when 5 or 6 discs are engaged the note is lower.

The difference in tone in the first war was used to be able to distinguish one airplane from another; in practice it was possible to identify and separate the messages of only 3 airplanes!!.

The Omnibus receiver adjusted to the best in the primary and secondary circuit, using the carborundum detector, has always allowed us to listen to the signal generated by the Marconcina through headphones.

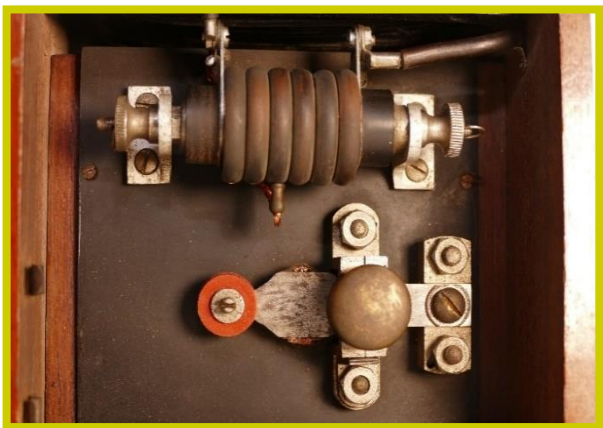


Photo N° 8 plug used to use 4, 5 or 6 discs

Headphone listening, however, can only be used by AIRE operators in charge of the work; wanting to make the audience present at the re-enactment listen to the Marconcina signal, it was necessary to build an efficient amplification system using a Darlington preamp that drive a power amplifier.

Once the ground tests have been successfully completed, we have begun to think actively about the tests with the Marconcina installed on the old biplane, of which we provide some features.

The De Havilland DH-82A Tiger Moth (Photo N° 9) is a single-engine, two-seater training biplane with open cockpit, built in England by the Havilland Company since the early 1930s.



Photo N° 9 the De Havilland DH-82A Tiger Moth

Until 1952 all RAF pilots were trained with this aircraft which, as its owner Gustavo Cappa Bava explained to me, is quite easy to fly badly, very difficult to fly well.

Here are some technical features:

Engine: De Havilland Gipsy Major, four-cylinder, air-cooled, inverted inline, about 120 Hp at 2350 rpm.

Length 7,34 m, Wingspan 8,94 m, Height 2,68 m, Wing surface 22,2 m²

Empty weight 506 kg, Fully loaded weight 828 kg, Cruise speed 130 km/h, Oil consumption kg 1 every 4 hours, Wooden propeller

Saturday, September 4th 2021, Aeritalia Airport in Torino, we saw the Tiger Moth for the first time

At 11-30 a dull engine noise heralds the arrival of a slender figure, similar to a dragonfly, which rests with great elegance on the grass landing strip, it was our Tiger Moth biplane perfectly on time!! I got closer, I got to meet the pilot Gustavo Cappa Bava owner of the Tiger.

I began to look with interest at the biplane, made with a steel and wood structure covered with waterproofed canvas. The perfectly restored aircraft has the English cockade and the original serial number DE-486; it is painted in perfectly original camouflage colours as when it started flying. The pilot's seat is behind the observer's seat, both positions have all the controls completely replicated to allow piloting from both places (Photo N° 10).

We started to learn more about the vehicle, Gustavo began to show me how to get on the Tiger without causing damage, how to fasten the seat belt, the various commands, how to behave during the flight, etc.



Photo N° 10 on-board instrumentation

Now with Gustavo's help we did all the tests to put the Marconcina on board and place it in the small cockpit, resting on my right leg (Photo N° 11).

The solution of positioning the Marconcina between the legs, on the seat in a central position, as the Marquis Solari did, was not practicable due to the presence of the yoke, which must move throughout its stroke and not in a limited position.

Close to my feet the Tiger 12 Volt battery could be the power source for our Marconcina. In order to avoid problems with the on-board equipment connected to it, I choose to use an additional battery of reduced dimensions and a weight of 2 kg held around the neck with a sturdy strap (Photos N° 12 and 13).



Photo N° 11 the Marconcina positioned on board



Photo N° 13 12 Volt battery with strap for use over the shoulder



Photo N° 12 The Marconcina with 12 Volt battery and telegraph key fixed with elastic

This battery, any other object and the electrical cables must not fall on the floor of the cockpit to avoid slipping under the pedal board and hindering the movement of the same with the impossibility of steering the aircraft.

And now we come to the very critical topic, the antenna

The solution adopted by the Marquis Solari to use a 25-meter wire with a weight of about 300 g hanging from the biplane (Photo N° 14) was evaluated but then considered dangerous and therefore discarded.



Photo N° 14 the 25-meter antenna, with a weight of about 300 g, which comes out of the biplane's cockpit

For this purpose we have made small PVC electrical insulators to be attached to the Tiger structure using strong nylon cables. A first insulator was connected to the tail boom (Photo N° 15), a second insulator connected completely to the right of the upper wing, a last insulator positioned under the upper wing, above the observer's cockpit near the tank of gasoline. The same thing was done on the left side of the biplane. Subsequently, a copper electrical cable with a length of about 22 meters, very similar to the length of 25 meters used during the positive tests carried out on the ground, was connected to these electrical insulators. Using an insulating plastic tube, clamped on the interplane strut, the wire was made to enter the observer's cockpit to be then connected to the antenna socket of the Marconcina (Photo N° 16).



Photo N° 15 isolator connected to the tail boom



Photo N° 16 electrical insulator and insulating tube clamped on the interplane strut to allow the antenna cable to enter the observer's cockpit

The threads have been well stretched to prevent them from bumping into the canvas of the wings during the flight, causing it to break. Another very critical point is the gasoline tank, here the cable crossed by high voltage electricity had to stay away from the tank and did not have to change its position when in flight.

At the end, using a short piece of wire, we connected the Marconcina earth socket to the tubular structure of the cockpit using an alligator clip.

Saturday, September 18th 2021 Aeritalia Airport, Torino

The big day has arrived, this morning we fly !!.

Gustavo explains the flight plan to me, we start from Aeritalia, aim for Rivalta, head for Orbassano, and up there we have to look for the chimney of the AER factory dryer. In the courtyard is the Omnibus receiver with all the soldiers involved in its operation and Guglielmo Marconi. We will make a few laps over the AER factory and then return to Aeritalia.

During the journey towards and away from Orbassano with the Marconcina I will transmit a series of signals in Morse code.

Gustavo checks the engine, adds 1 kg of oil and then refills the tank halfway between the two upper wings.

I get on the biplane, Gustavo helps me to close the seat belt, puts the headset on my head, hands me the Marconcina that I connect to the antenna / earth cables, I put the battery around my neck, I'm ready.

Gustavo is now preparing for the propeller launch while I am in charge of the petrol tap and the magnet switches "" two small rubber-covered switches positioned outside the cockpit on the left side "" (Photo N° 17).



Photo N° 17 external magnet switches



Photo N° 18 the radio operator and the pilot waiting for take-off

A first launch of the propeller, the second launch of the propeller, finally the third launch and the engine starts to crackle and stabilizes at 800 rpm. The 4-cylinder begins to make its rumbling sound.

Gustavo gets on board (Photo N° 18), adjusts his headset, fastens the seat belts and gently moves the Tiger to the waiting point.

Gustavo contact the control tower, ""Aeritalia for Tiger Moth we are ready for take-off"", and after a few moments here is the control tower "" Tiger Moth you can take off "".

The engine starts to turn in a sustained way, the Tiger starts to run fast on the track, raises its tail and then immediately comes off the ground, we are in the air, what a thrill !! and even a pinch of fear!!.

Beautiful, the adrenaline is at its peak, we fly over the cultivated fields, the farmhouses, the houses, the ring road, the roads, the waterways, we travel at about 1.000 feet.

The Tiger jolts and rocks slightly, Gustavo with the yoke and the pedal board always keeps it in perfect position, the engine has reached 2.100 rpm, all the tie rods are perfectly taut, in front of my face a small dashboard with 3 glass protects me from the air and from the air produced by the wooden propeller. To tell the truth this dashboard also protects me from very small splashes of oil of which the Tiger is very greedy.

I check the insulators and the cables of our antenna / earth system, they are perfectly taut, do not rattle, behave well.

Almost arrived in Rivalta I start telegraphing SSS SSS VVV VVV; the antenna ammeter always shows 0,35 Ampere. We approach Orbassano, we begin to fly over the first houses, then we see the large complex of houses arranged in a U shape and behind the AER dryer with its red brick chimney. I have never stopped telegraphing; with relief I see that on the ground the soldiers have already arranged the sheets to form a V, so it means that they have been hearing and hearing us for some time. On the ground we also see the soldiers who greet us and wave their arms... ..it is done they are receiving us (Photo N° 19).



Photo N° 19 AER dryer with red brick chimney, on the ground the sheets arranged in a V shape

Even listening to what I am transmitting in Morse with the noise on board is impossible, the Tiger intercom helps me, in practice I listen to myself with the intercom.

In the courtyard of the AER there are also radio amateurs from the ARI "Italian Radio Amateurs Association" Section of Torino who, using the special call I11TRM, have connected other radio amateurs around the world.

We continue to fly over the AER and I continue to transmit, now with some changes, HELLO AIRE, HELLO ARI, HELLO ALL, ecc. ecc.

During the return trip I identify myself in the shoes of those soldiers who, after a short training course, were put on Caudron G-3 biplanes and sent to war. Now we are flying at a height of about 300 meters at a speed of 120 km / h, we would be an easy target for the enemy infantry armed with even a simple rifle.

Here is the Aeritalia airport approaching at the bottom; now I resume playing my role in the figure of the Marquis Solari, the Tiger whirls over the last constructions, veers to the left, lowers gently, the engine decreases the revs, and with elegance (contrary to what happened in September 1915) it leans gently on the grass. Guglielmo Marconi and the military approach running, "all right?" "Yes, all right, thank you", I answer; I quickly learn that the morse messages have been received with the Omnibus receiver loud and clear.

Today we have shown that it is possible to transmit telegraph radio signals from an airplane in flight and receive them on the ground with a field receiver, comments Guglielmo Marconi, the military leaders agree.

Sunday, September 19th 2021, Aeritalia Airport, Torino

As scheduled on this day, we made 3 further flights, the first at 11-00, the second at 15-00 and the last at 16-00 using a formula tested the previous day. In both flights I continued to play the role of radio telegraph operator, while on the ground the military always arranged the sheets to form a V to confirm the reception of the signals.

The sensation as in the previous flights is difficult to describe, the air caresses my face, when I try to lean a little to the right of the glass dome, the air definitely hits the face but in any case, the Tiger is piloted with the head always slightly off.

On this day on the biplane, a special camera, the INSTA ONE 360 X2 that allows you to capture 360° images in high definition was placed. The assembly of the images was then carried out professionally by the AIRE Piemonte member Claudio Girivetto, making videos, visible on the AIRE Piemonte YouTube channel <https://youtu.be/Q5hQcDDmnU> or <https://youtu.be/fkvNmWEelxo> that manage to convey the emotions experienced on the biplane to the reader.

The last flyof of the day I do it's with Gian Luca Perotti as partner. Now I see that the flight is about to end, I see the Aeritalia airport approaching, I realize that in the last few days I have had an experience that will be unforgettable for me, despite the turbulence I would like to stay in flight again, I would like not to get off the Tiger, I would like to continue to feel the air in my face, but all good things have an end, who knows if one day I will still be able to fly with the Tiger.

In an era in which technologically we have practically all or almost all this historical re-enactment is meant to be a tribute and a thank you to all those people, thinkers, aviators, radio telegraphers, engineers who with their work done with a romantic and pioneering spirit and often in a heroic way have allowed to achieve today's technological results.

Now the time has come to say goodbye to you readers, thank you for your attention "" maybe I was a bit boring "" at the next historical re-enactment then.

AIRE Member N° 0171
Alberto Genova, I1 VXA





**First Radio Telegraphist and Dirigibiliste Battalion at AER Orbassano Torino 1915
Commander Andrea Ferrero**



Commander Achille Celloni

Sec.Lieutenant. Guglielmo Marconi

Radio Telegraphist Marquis Solari

Interpreted by: Andrea Ferrero

Alberto Ferrero

Alberto Genova

Orbassano (TO) 1915 -2021