Aerial photographs taken from a kite

Yesterday and today

Geoffroy de BEAUFFORT
Michel DUSARIEZ

KAPWA-FOUNDATION PUBLISHING
1995

Aerial photographs taken from a kite

10 numbered copies of the present book have been printed with a double suite of the drawing AERIAL VIEW by José SOLE

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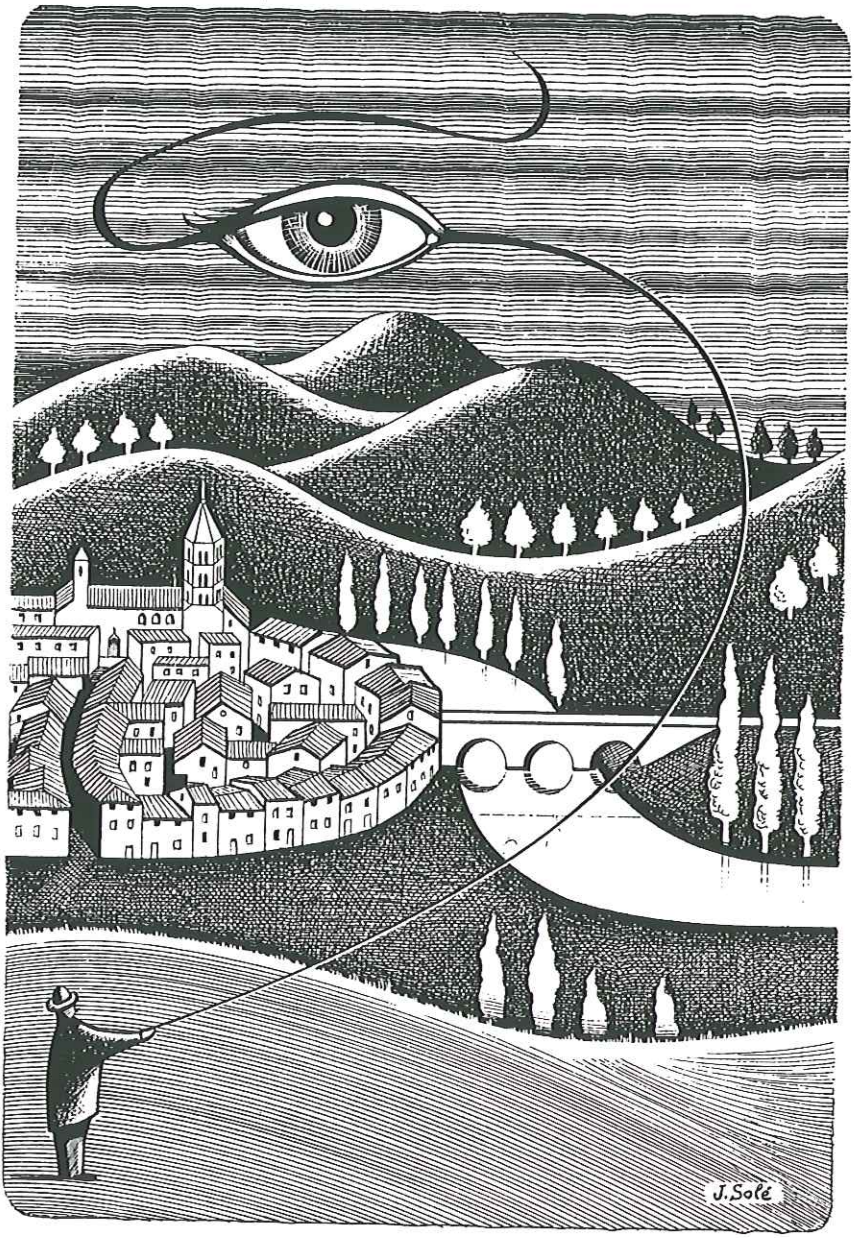


AERIAL VIEW

Drawing by José SOLE - Labruguière (France) - 1988.

Symbolic and poetic composition in memory of the centenary of the invention of aerial photography by kite, by Arthur BATUT of Labruguière.

Nothing can be done well
without passion.

CONTENTS

The names which appear in the margin in certain parts of this book will enable the reader to know the names of the correspondents who have forwarded the information concerned. It may be an original contribution or notification of a previous reference.

PREFACE

Kite aerial photography has become relatively easy thanks to the wide range of material available to the amateur nowadays.

Nowadays, all it requires is a bit of common sense and experience, and with no great risk you are able to produce results which will amaze even the most blasé.

However, we cannot strongly enough emphasise the element of safety which must always prevail over any other consideration, be it in the choice of the various components of the equipment, the regular check-ups of these components or during photographic flight itself.

Nothing should be left to chance, and safety should constantly be on the mind of the operator. Further on we will mention some of the basic rules which should be carefully respected by everyone and at all times.

This handbook is for beginners as well as for the experienced. It consists of historical, theoretical and practical texts written by the authors and of a compilation of articles from our members, previously published in KAPWA periodicals. So it really is the result of long and wide, collective and international experience.

When Michel DUSARIEZ and Geoffroy de BEAUFFORT met in 1979 they were both practising kite aerial photography already, but there was not, as yet, anywhere in the world, any sort of association dealing with this speciality which was still very rare then.

That is why, back in 1985 Michel DUSARIEZ founded the first ever organisation specifically oriented towards this activity which was almost 100 years old. KAPWA was born. Its purpose was to group together amateur kite aerial photographers from all over the world and to distribute all past and present knowledge of the subject. Geoffroy de BEAUFFORT, a specialist in the history of science and technology, joined the team. For eight years, four times a year, KAPWA published illustrated bilingual periodicals which were distributed over the 5 continents, progressing as the association developed. At the end of 1993, the original KAPWA became KAPWA-FOUNDATION, transforming the cycle of its activities but maintaining the same team.

The publication of a handbook had been planned for a long time. The reservoir of information available was so vast that limits had to be set and only some essential points dealt with. Several smaller papers had already been written on the subject; kiting alone has supplied material for a whole library. And since our specialty is being enriched with new conquests every day, it is not impossible, if the demand arises, that the authors might publish a second complementary volume later.

The objective of the handbook is to summarise what is happening, give a general idea of our discipline, bring together in a little volume the basics of how it is done, give information on the value of its applications and as much as possible encourage its extension.

GENERAL RECOMMENDATIONS

Obviously, in publishing the information contained in this volume, the authors refuse to assume any responsibility whatsoever for results obtained or any accidents which might results from the application of the procedures described here.

We have mentioned it already; the greatest care is necessary when practising kite aerial photography, and you should remain careful throughout.

Kite aerial photographers should also check up on relevant legislation in each region or country where they plan to practise kite aerial photography.

Apart from the precautions and checks to be done on the material, you should also remember the circumstances in which a kite should absolutely not be flown, whether it carries a camera or not.

- During high winds, gusts or storms and thunderstorms (always make sure that the flying line remains dry)

- Near electricity cables (if there is accidental contact, call the fire brigade)

- Near airports or airfields

- Above roads or crowds of people

The line should not contain conducting metal.

You should use gloves when handling any kite with a traction of more than 3 kg.

It is simply not possible to mention exhaustively all the safety rules and

do's and don'ts to follow, but we insist on the few, we have mentioned because they can ensure that our activity continues.

KITE AERIAL PHOTOGRAPHY

Worldwide Association

FOUNDATION

LABRUGUIERE - Tarn - (France) - Aerial photograph by kite taken by Eric REGOUT©
in 1988 during the celebration of the centenary of the invention

Aerial photographs taken from a kite

Aerial photographs taken from a kite

THE EYE IN THE SKY

One hundred years of kite aerial photography

1. THE INVENTION

The ancient civilisations of the Middle East , where geometry was born into great agricultural societies, handed down to us, engraved in clay, the most ancient anticipations we know of an aerial view of the world.

Throughout the ages, graphic representation of perspectives and the vertical projection of geographical sketches have continually been perfected until the appearance of aerial photography which introduced scientific rigour.

We do not plan to retrace or even just give an outline here of the history of aerial photography or of its numerous technical and aesthetical applications; let us simply remember that already in 1858, the Frenchman Felix TOURNACHON, known to the world as NADAR, filed the very first application for a patent for a "system for photography by balloons, applicable to making topographical surveys".

And it was finally in 1888 that another Frenchman, Arthur BATUT, from ENLAURE (Tarn) sent the results of his first attempts in kite aerial photography to the popular scientific magazine NATURE.

A short time later, the inventor of this original procedure published some wonderful photographs taken from above the neighbouring village of LABRUGUIERE. The photographic camera used by BATUT had been built by himself from lightweight wood; it used 9 x12 cm glass plates and had a guillotine shutter which gave speeds of about 1/150 of a second.

The camera was attached to the wooden frame of a large primitive, diamond shaped kite, with a long tail. The camera was activated by

lighting a time fuse, the length of which had been calculated in advance. A long, pleated strip of paper would unfurl to tell the operator that the photograph had been taken.

Those of our readers who already practise aerial photography will realise fully how sharpness and correct orientation of a picture taken under such conditions and with such a slow shutter speed, remain uncertain.

In aerial photography as in many other fields, generous competition was one of the motors of progress.

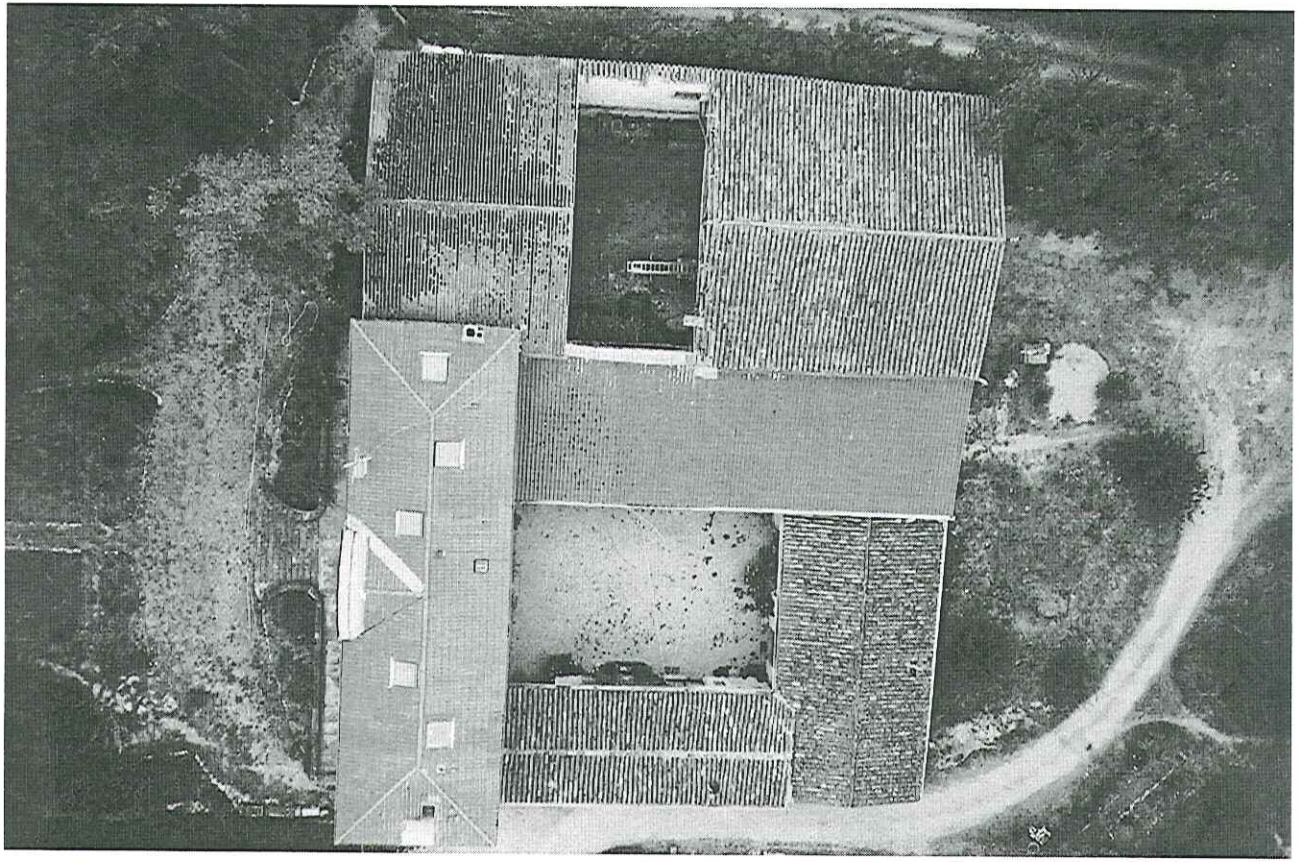
It was upon the the inspiration of BATUTs work that in August 1890 Emile WENZ, a wool merchant from Reims, took his first aerial photographs from kite on 11 x 15.5 cm glass plates. He contracted BATUT and they corresponded regularly.

Their correspondence was to go on for many years, each of the two pioneers telling the other of progress accomplished and of obstacles overcome.

Very early, the two pioneers agreed to abandon the initial idea of fixing the camera on the kite itself. This was done to avoid having to land the whole rig after each take and then having to relaunch the kite. The camera, with its timer device was suspended from a point on the tether line, a few dozen metres below the kite. In this way, it could be brought down to the ground after each photograph for the plates to be switched, for the shutter to be re-cocked and for the timer device to be re-armed, without having to interrupt the flight of the kite.

The choice of where to attach the camera was determined by the moment the kite had attained sufficient altitude to find stable winds.

Flat kites were abandoned in favour of cellular, invented by the Australian Sir Lawrence HARGRAVE. It was a biplane type, with vertical stabilisers,



The farm of ENLAURE, residence of Arthur BATUT who invented aerial photography by kite in 1888.
Aerial photograph by kite by Michel DUSARIEZ 1988 ©

and no tail and with a lifting capacity to surpass anything which had existed before.

It is true to say that all cellular kites constructed and perfected since then are derived from the HARGRAVE. All sorts of additions and modifications have been made according to the calculations of scientists or simply to trial and error of ardent amateurs

Observatories all over the world used them to carry out very high altitude atmospheric tests and armies harnessed them in trains to send up observers in a basket.

The burning wick time fuse systems were gradually replaced by mechanical or electrical systems.

After widespread searching, Emile WENZ chose the site of BERCK-PLAGE in the Pas-de-Calais region of France to carry out his aerial photography experiments.

Disseminated by the press, WENZ's activities caused widespread interest and attracted many pioneers of the conquest of the sky to these vast beaches. Gabriel VOISIN one of the pioneers of French aviation carried out his first attempts at gliding here in 1904.

From then on, things advanced quickly and all kite aerial photographers in France came to BERCK-PLAGE which became the most photographed town from the air before World War I.

The obvious logic of kiting applied to aerial photography, the low cost of the equipment necessary, the beauty of it all and the whole new interest in the results meant that at the beginning of the century, several firms decided to market complete outfits for amateurs.

There were various ingenious ideas to perfect directional suspension

devices for cameras.

One activation system often used consisted of a sort of sail called a "line-climber" which, pushed by the wind, went up the line and at the end of its run activated the shutter release.

At the turn of the century, the kite thus became the instrument of democratisation of aerial photography and this was at a time when balloon flights were no easy matter.

In favour of their activity, the amateurs of kite aerial photography insisted that photographs taken from the basket of a balloon after many costly manoeuvres, produced nothing but a souvenir on film of an adventure experienced.

On the contrary, the result obtained with a camera carried by kite created time and again, albeit with less perfection of framing, the emotion of discovery of unseen landscapes.

In fact, the amateur experienced a totally different satisfaction, when back in his darkroom he could observe, in the dimness left by the red light, this aerial picture of a familiar site so strange, so surprising, so magic appearing slowly, little by little, on the photographic paper in the bottom of the developing tray.

The horizontal view of the site was part of his daily surroundings and a simple kite had managed to bring a new impression of it from the sky.

Let us add that before 1914, on a utilitary basis, kite aerial photography saw numerous applications in fields such as topography, geology, archeological research, meteorology, military observation etc. where both its reliability and its frequent superiority over other methods in use, were demonstrated.

Aerial photographs taken from a kite

II - CONQUERING THE SKY...WITH YOUR FEET ON THE GROUND.

The practice of aerial photography by kite soon crossed oceans.

The first photo of this kind which showed a site in the New World was taken in May 1895. It was the work of an American journalist, William A. EDDY, from BAYONNE (New Jersey).

This American pioneer took 3.5 x 3.5 inch pictures by lifting his camera using a train of diamond shaped dihedral kites, with no tail, inspired by Malaysian kites.

Some months later - 21st September 1895 - another American, Gilbert Totten WOGLOM, took a first series of photographs of the city of NEW YORK. A large-size camera using negatives on a 6.5 x 8.5 inch glass plate was very cleverly chosen to obtain the highest quality in the details.

To manage flight and recovery of the camera in the middle of New York in the limited space available to him in Washington Square, WOGLOM used a train of small Malaysian kites, similar if not identical to EDDY's kites. The number varied in his various experiments, from five to eight, according to the force of the wind.

These little kites were not bulky and were easy to launch. They were attached at a few dozen metres interval, to the kite line, thus forming a train where each one added its lifting power to the whole. WOGLOM reported the details of his experiments in a very interesting and well illustrated book.

KITE OR BALLOON ?

THE AERIAL PHOTOGRAPH OF THE SAN FRANCISCO DISASTER - 1906.

The panoramic aerial photograph showing the still smoking ruins of SAN FRANCISCO (U.S.A.) after the 1906 earthquake which was followed by a gigantic fire which was to devastate several parts of the town is famous. This photograph of surprising quality and sharpness was said by its author George LAWRENCE to have been taken from a tethered balloon. Despite this, several American kiting enthusiasts, supported by Mr. Simon BAKER are trying to twist history by claiming, against all evidence that this famous photograph was taken by kite.

Geoffroy de BEAUFFORT, author of the present chapter of the book, refutes this manipulation. It is far from being the first in the history of kiting. The limited scope and space of this book does not permit us to go further into the arguments of this controversy; which must thus remain open.

Already at the beginning of the 20th century, the observatories of Trappes, Nantes and Puy-de-Dôme, all in France used a photographic device invented by Emile WENZ, designed to record the indications of instruments lifted to a high altitude by kites (5.250 m at Trappes in 1901). At the observatories of Blue Hill (USA), Pavlovsk (Russia) and Lindenberg (Germany), kite aerial photography was also used at the same time for scientific purposes.

Aerial photographs taken from a kite

On 1st August 1919, under the direction of Dr. Richard ASSMANN, the altitude record of 9737 metres was broken at the observatory of Lindenberg by measurement instruments which were lifted using a train of eight HARGRAVE kites.

In Belgium, it was not until August 1905 that the Ghent photographer, Armand GODERUS, published a long and very well illustrated article, entitled "Le cerf-volant photographe" in the paper of the Belgian Photographic Association, where he spoke of the successes of his recent attempts on the Belgian coast. He may have been an innovator in his own country but very shortly he was followed by various other aerial photographers, among whom Francis DEMBLON, also from Ghent.

However, it was René DESCLEE from Tournai who was to cause the most interest in this photographic technique. He often flew his kite in the sky above Tournai. We do not have the space here to develop details of the life of this idealist who, from 1910 to 1939 practised kite aerial photography like an art with a consistent high quality which was to remain unequalled.

Those who wish to know more about René DESCLEE, this grand master, can refer to the very complete text by Geoffroy de BEAUFFORT in "RENE DESCLEE, PHOTOGRAPHE TOURNAISIEN - 1868-1953", published in 1988 (In 8° - 208 pages - 270 ill. © Archéologie Industrielle de Tournai (a.s.b.l.) éditeur. Let us say only briefly that over 30 years, René DESCLEE produced 124 aerial photographs, each one more beautiful than the preceding.

These remarkable pictures, particularly those of the city of Tournai and its cathedral, remain the best photographs taken by kite anywhere in the world before World War II. René DESCLEE's kites and all his material have been preserved.

In the period between the two World Wars, the progress in aviation

reduced photographic kiting to the role of a simple curiosity which was becoming more and more rare. It was not until the sixties that the experiments of the American ROGALLO drew the attention of NASA to completely new shapes and structures of kites. A new wave of interest followed which, from America, spread to the whole world and kiting clubs are now everywhere.

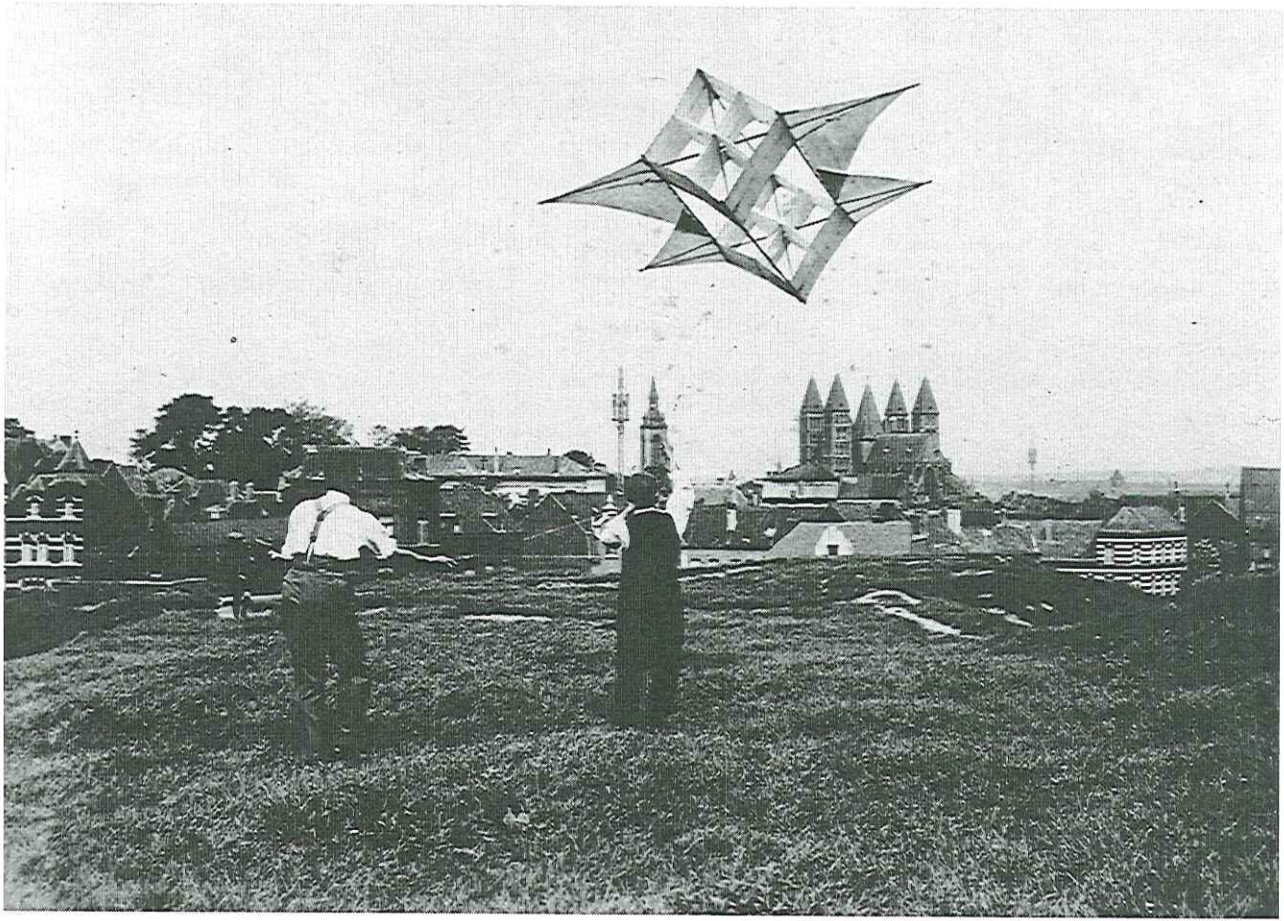
Stunt kites, which have become popular in recent years, have accentuated the craze for the sport.

As stated in the preface, it was in Belgium in 1985 that Michel DUSARIEZ together with Geoffroy de BEAUFFORT and David TOWN (USA), founded an international group with the aim to circulate the techniques used in kite aerial photography in various countries. The KITE AERIAL PHOTOGRAPHY WORLDWIDE ASSOCIATION (KAPWA), which is based in Brussels unites kite aerial photographers from all over the world. During the eight following years, it published a large bilingual (French-English) quarterly magazine bursting with highly interesting practical information. At the end of 1993 it evolved into the KAPWA-FOUNDATION.

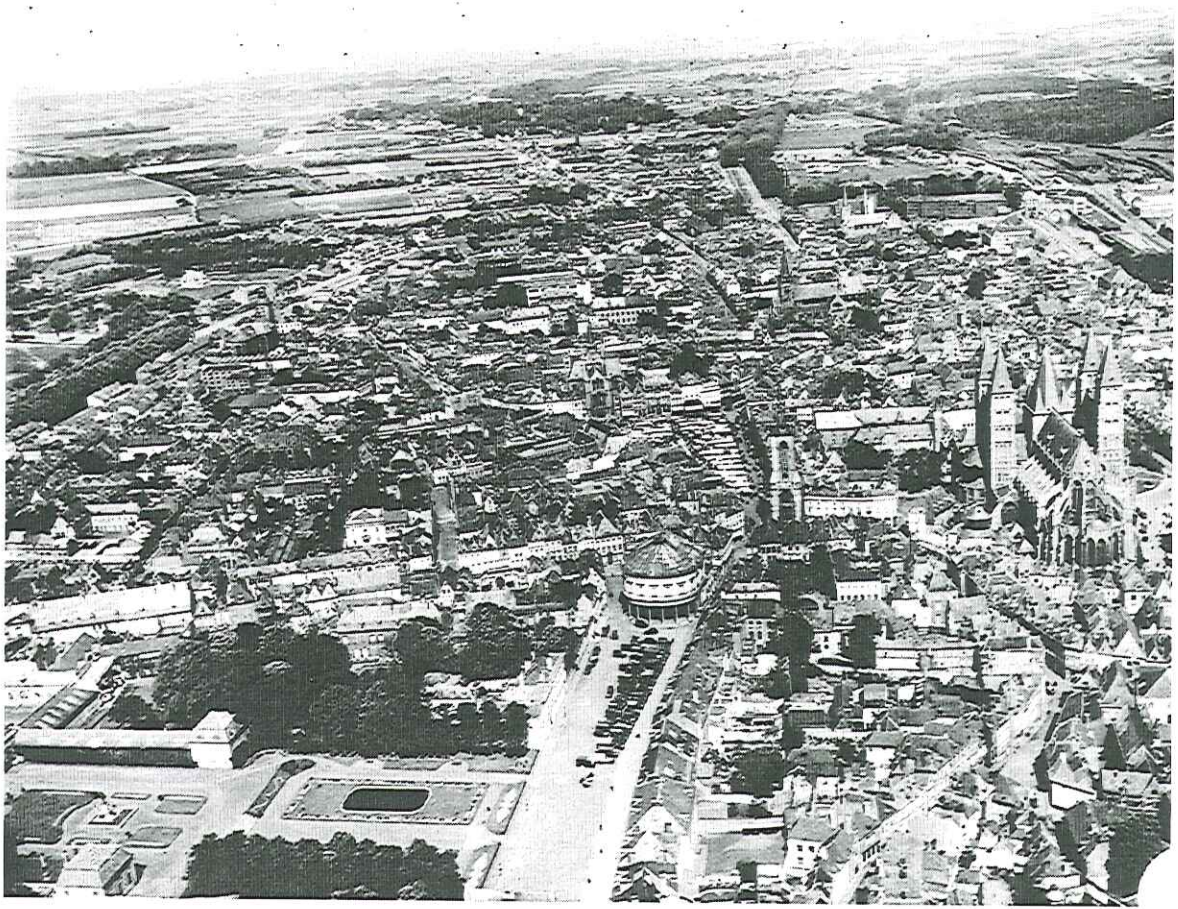
There are now hundreds of kite aerial photographers all over the world. Even if the original invention had already stood the test of time, it also lent itself to further development and this soon came to light. There was in fact a great rush of it in the years that followed.

For three quarters of the century automatic kite aerial photography was not as easy as it has become today. You had to be a real enthusiast to put up with the inconveniences, and an accomplished artist to obtain consistency in success.

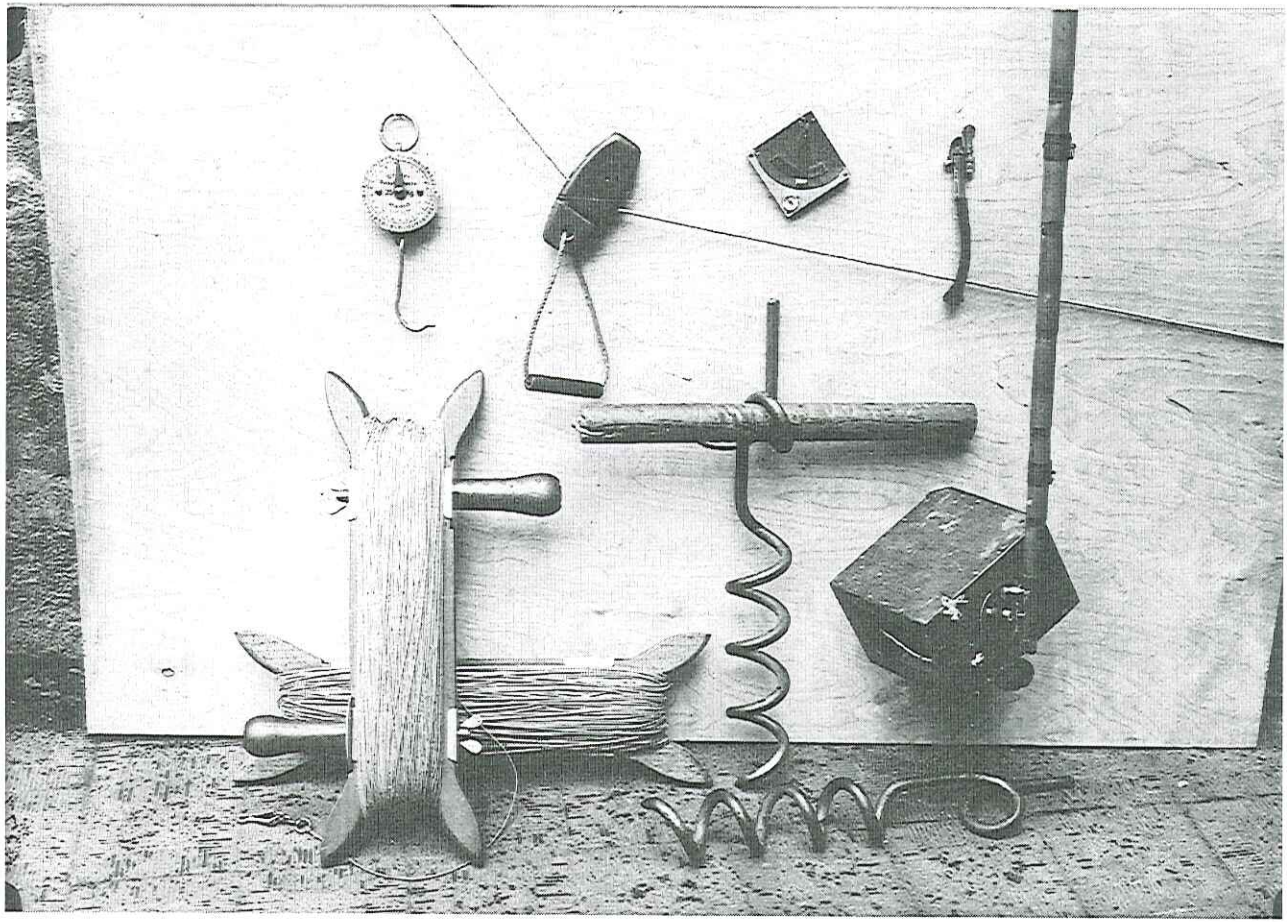
Over the years, the evolution of the techniques has removed the initial hardship. So much so, that now miniaturisation of optic and electronic components already makes it possible - from the ground - to have visual



Albert and René DESCLEE handling their photographic kite at TOURNAY (Belgium)
on the 12th May 1932 - Photograph by Jules MESSIAEN ©



Panorama of the Grand Place of TOURNAY - (Belgium) taken from the vicinity of the Citadel - 21- 05-1932 (RD6410)
Aerial photograph taken by René DESCLEE - Bernard DESCLEE Collection ©



Accessories for aerial photography by kite used by René DESCLEE - 28.12.1931
(RD 6379) - Photo Jules MESSIAEN ©

control over the framing of the picture seen by the camera in flight; the orientation of the camera has been remote controlled for many years now.

We believe that history of technology has the advantage over the history of peoples, that it does not permit regression. Sooner or later it rejects outdated ideas.

One could have thought that the arrival of so many sorts of flying machines would eclipse the kite. Not at all. On the contrary, nowadays aerial photography calls on kiting much more than it ever did in the past. And this all over the world, and for so many different applications: sport, science, archeology etc. that we simply cannot go into them all here.

Aerial photographers can now find, at reasonable prices, all the ease and precision of radio-controlled activation, motors to wind the film and cock the shutter, radio controls which will point the camera in any given direction and trigger it.

The rapid advance of new technology, both within photography and within telecommunications makes it possible to foresee numerous other applications for kite aerial photography in a not too distant future.

The last quarter of the century after the invention will have made it undergo its most important metamorphoses, having liberated it from many of its incertitudes and at the same time having robbed it of part of its mystery.

The pioneers BATUT and WENZ, whose work cannot be dissociated, realised perfectly well that that all they had was riches to be handed down to us. Like all really wise men, they realised the relative and provisional character of their most beautiful discoveries. Thanks to them, the past is alive and lives on in the universe, subconsciously. It is upon this past that our experience and all our knowledge of today is built.

In summing up a few of the historic stages of kite aerial photography, our survey claims no other merits than that of carving a few legends in the margin of this grand album of aerial photographs which down through the years has been steadily enriched by the practicians of our discipline.

KITE AERIAL PHOTOGRAPHY
WHY, AND BY WHOM ?

- Geoffroy de BEAUFFORT - born in Brussels in 1929.

In 1958, the year of the Word Fair in Brussels, he took several aerial photographs of Libois castle, (BELGIUM) home of his grandparents, using a kite. This cellular kite with aluminium frame and nylon tissue had been made by the motorcycle champion André MILHOUX.

Participated with Michel DUSARIEZ in the foundation of the short-lived Kite Club of Belgium, then in that of the "Nouveau Cervoliste Belge" (NCB) and, finally in 1985 in the foundation of KAPWA.

Founder member, then administrator of KAPWA, Geoffroy de BEAUFFORT discretely seconded the management, faithful to the goals of the Association.

- Michel DUSARIEZ - born in Brussels in 1938.
Optician-Optometrist since 1958.

Discovered adult kiting in 1978 and immediately considered the idea of taking photographs by this means of elevation.

Built an ultra light 10 x 15 cm camera to take his first photograph by kite a year later in June 1979.

Participated in the foundation of the short-lived Kite Club of Belgium in 1979.

Founded "Le Nouveau Cervoliste Belge" N.C.B., Belgian kite club in 1980, which he presided for the first 5 years.

In 1985, Founded the KAPWA - Kite Aerial Photography Worldwide Association - with Geoffroy de BEAUFFORT -

Since 1978 he has been involved in countless projects within kite aerial photography among others the building of an ultra-light 4 x 5" camera with a clockwork timer, several systems, some of them modular for photography with SLR cameras like the CANON T 70, an automatic system for taking photographs with a small compact camera, the RICOH FF9 (in USA RICOH Shotmaster) which was the first camera with an intervallometer, specially designed for the kite photographer.

As a technical challenge he also built and used a 8 x 10" camera, and has also been engaged in stereoscopic and very recently panoptic panorama kite photography.

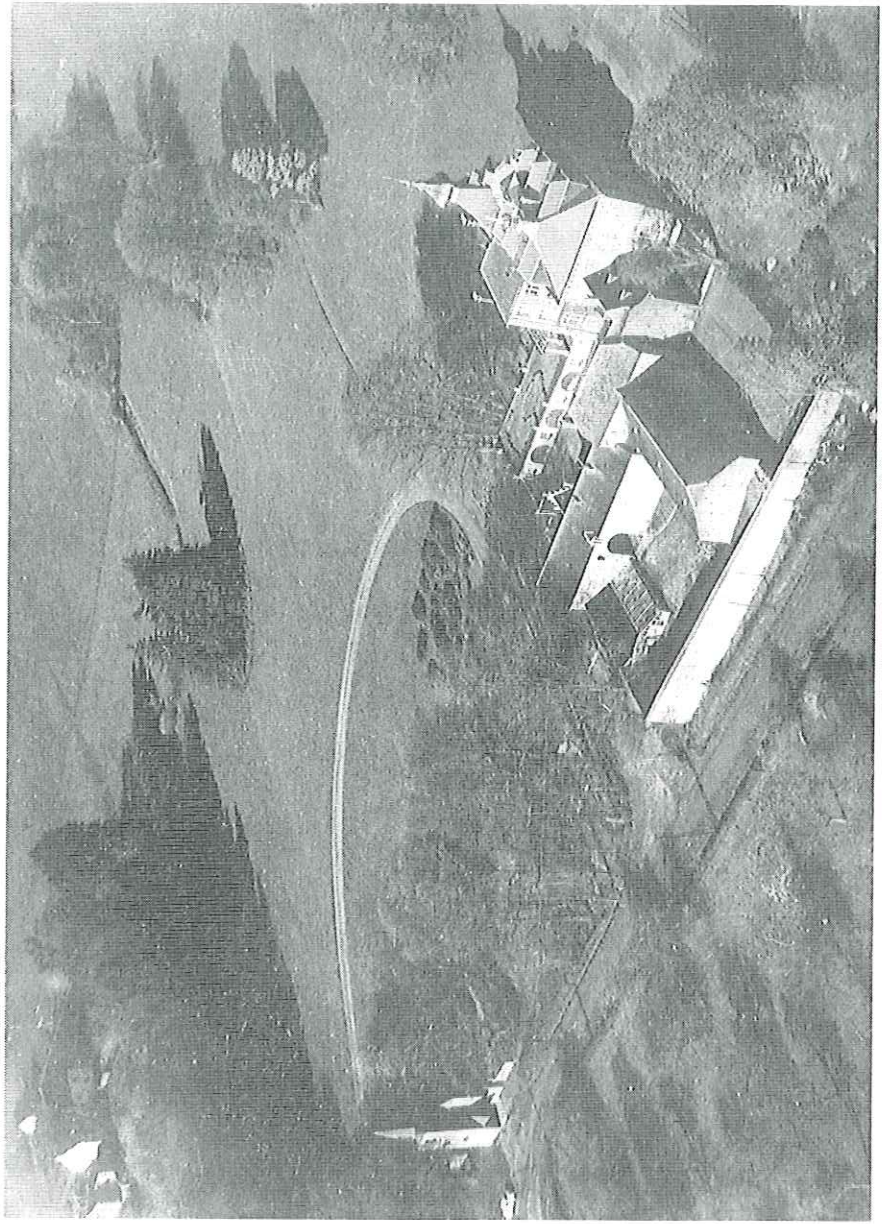
KAPWA AND THE KAPWA-FOUNDATION.

KITE AERIAL PHOTOGRAPHY WORLD ASSOCIATION, a worldwide association grouping together people who use the kite as a means to lift the camera. At the end of 1993, KAPWA became KAPWA-FOUNDATION with the same objectives.

After 8 years of existence KAPWA had no less than 420 members, many of whom contributed information to a quarterly publication, KAPWA MAGAZINE which in 1990 became KAPWA NEWS and TECHNIQUE. All in all nearly 1500 pages on the subject. We should add that all KAPWA publications have been entirely bilingual, French/English.

Since its creation, KAPWA has been run by Michel DUSARIEZ,

Aerial photographs taken from a kite



Castle of LIBOIS (Belgium)
Aerial photograph by kite taken in 1958 by Geoffroy de BEAUFFORT - Brussels (Belgium) ©

president, and Geoffroy de BEAUFFORT, administrator and science and technology historian.

The process of kite aerial photography was invented and practised from 1888 by the Frenchman Arthur BATUT from Labruguière in the Tarn-FRANCE.

In 1986, after detailed historical research which proved the originality of BATUT's invention, a fact which had hitherto been contested, we contacted Serge NEGRE of Labruguière who was already in contact with descendants of Arthur BATUT. We strongly encouraged him to group together the rich archives left by the inventor and suggested the creation of a kite photography museum at Labruguière.

The museum project was accepted and it was created in 1988. The inauguration took place during the festivities to commemorate the centenary of the invention; the commemoration was organised in close cooperation with KAPWA.

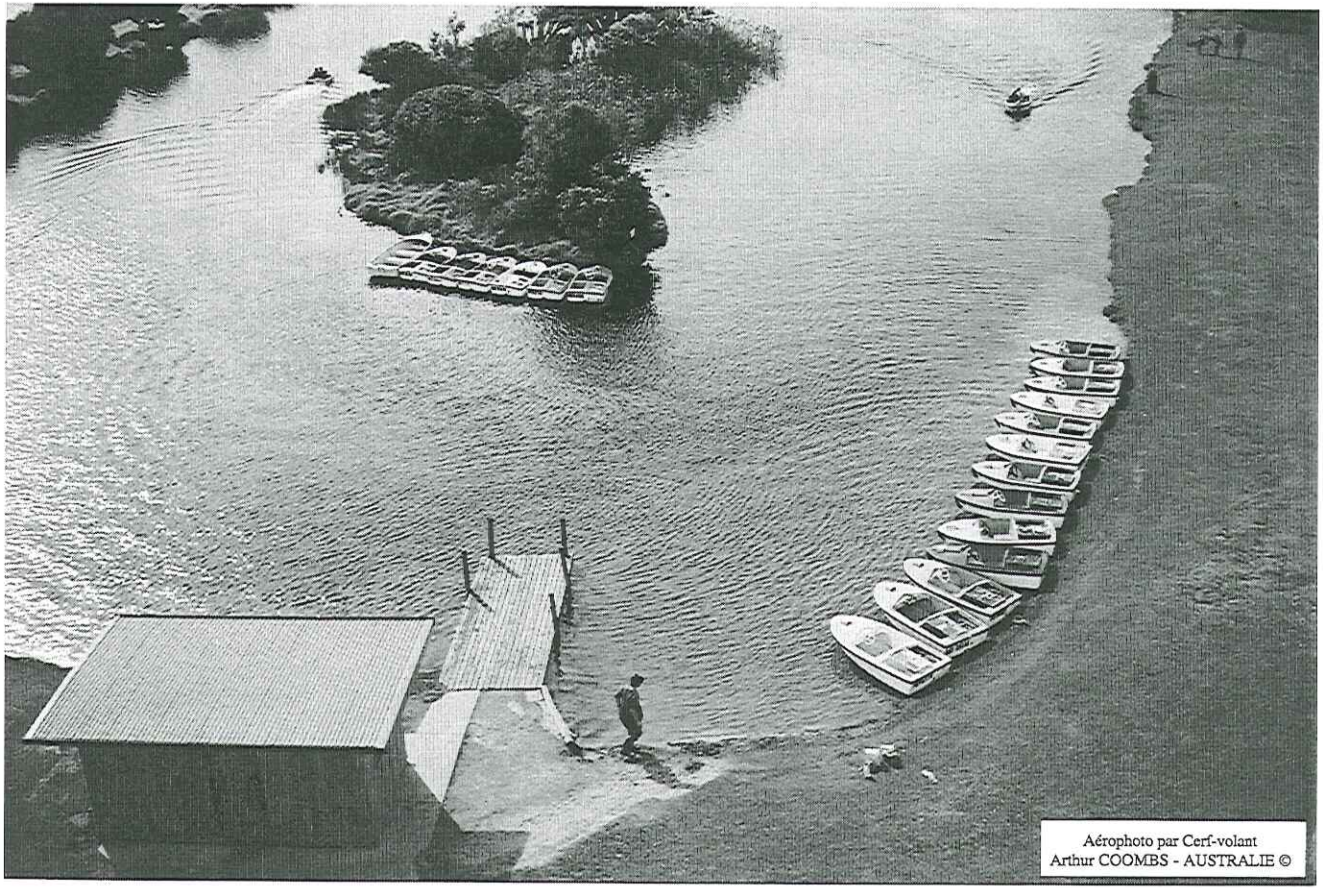
Following an idea of Geoffroy de BEAUFFORT, KAPWA on its own, organised and entirely created the First KAPWA Event at BERCK-PLAGE in 1987, an important historical site for kite photography. The event developed over the first 3 years and then along came Gérard CLEMENT, president of the completely new French Kiting Federation. In shameful manner, and in collusion with the municipality he hi-jacked the organisation of the Event which we had created.

From then until 1993 our annual meetings of KAPWA took place during the "CERVOLING du TOUQUET" created by Jean-Christophe MINOT.

A detestable evolution, as we see it, has been going on for several years in association kiting, which more and more is falling into the hands of organisations whose only objectives are business and profit seeking

This orientation which goes right against the grain of the impartiality which has always guided KAPWA, has led our association to no longer participate officially in big kiting events.

Since 1993, The KAPWA team have been exchanging information with our old friends of the Japanese Kite Photographic Association, who in 1989 organised the first symposium on the subject in TOKYO. We were able to take part in this symposium.



Boats in the park
Aerial photograph by kite by Arthur COOMBS - Australia ©

WHICH KITE TO CHOOSE ?

The choice of the most appropriate kite for aerial photography depends both on the weight of the gear to be lifted and the force of the wind at the time. The two important points are: stability and lifting power.

It is all a question of common sense and of measure.

It is self evident that a hardly perceptible breeze is not enough to make a kite fly with a load such as photographic hardware. On the other hand, strong gusty winds would make kite and rig unstable and would probably result in blurred photographs. Not to mention the risk of loss of and damage to equipment .

Is it necessary to say that the same thing goes for the choice of type and size of kite? The type of kite as a function of the wind force, and the size as a function of the weight the be lifted.

Furthermore, it is worth remembering that in hilly regions or near towns, the force and even the direction of the wind could vary a lot according to the altitude of the kite in flight.

At any rate, the best aerial photographs are usually taken in light wind. The ideal traction on the kite line is approximately three times the weight of the equipment to be lifted. A spring balance may be useful to get an exact idea of the traction.

Each type of kite - in different sizes - can thus be used to lift different loads.

It is important that you be familiar with the behaviour of your kite in

flight before actually attaching your camera to it. A test flight with a similar load is advisable and very instructive. As everyone has his own preferences we will make a summary here based on our own experience and that of our many correspondents.

Here are 4 types of kites which have worked well :

- The light delta for very light wind
- The delta for light wind
- The rokkaku for medium wind
- The cellular kite for moderate to strong winds.

Common sense will tell us when to abstain from photographing when bad or unstable weather makes it dangerous. Soft kites like parafoils should be used with caution, as they are difficult to adjust for good stability and reliability in flight.

When building a kite, there are some important rules to remember.

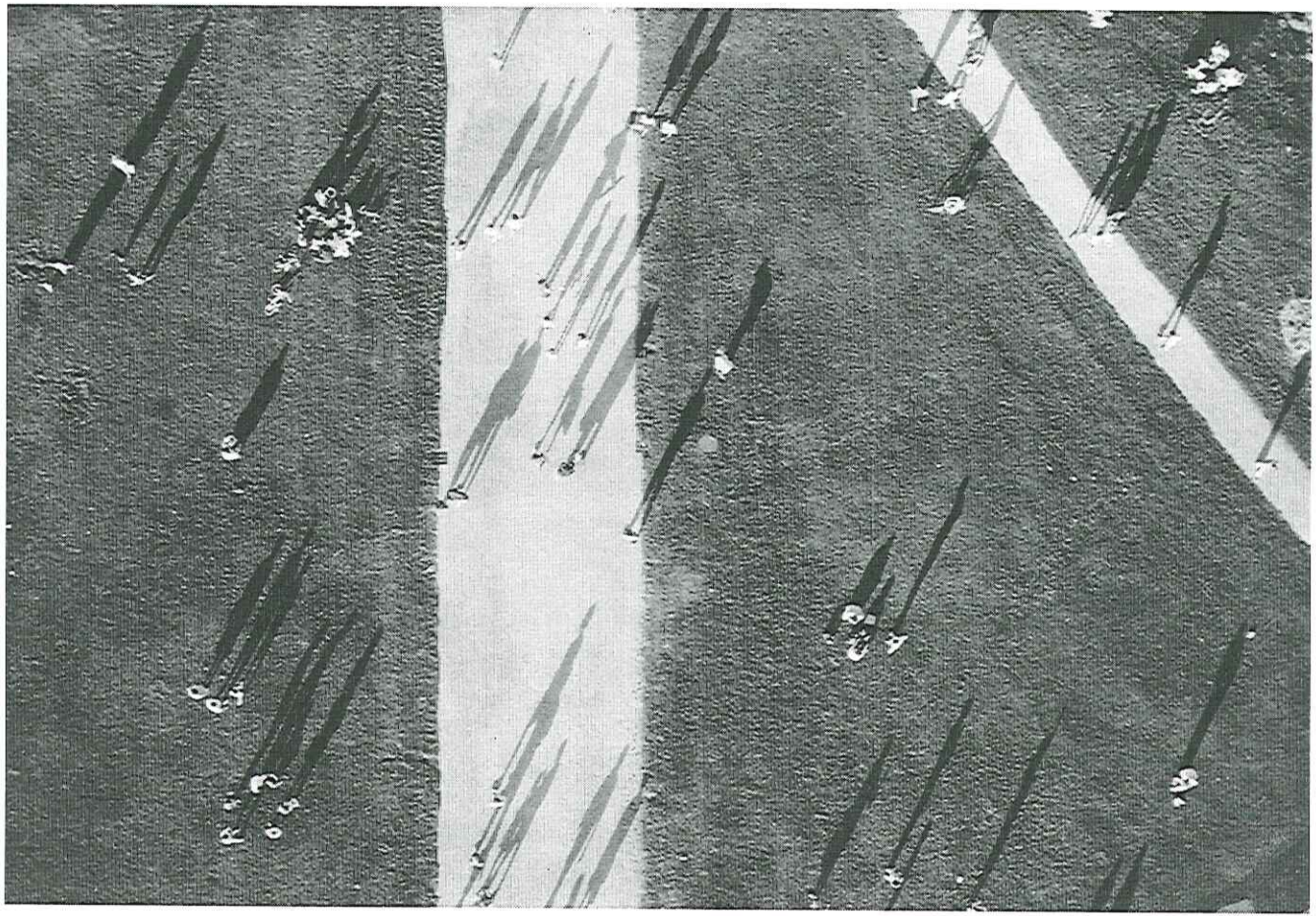
- Lateral symmetry must be respected, both for size and weight of materials, fabric and frame. The direction of the fabric weave must be the same for each of the two sides of the vertical symmetrical axis.

- The structure in wood, bamboo, glass fibre, carbon fibre or aluminium must be in proportion to the size and type of kite.

- Seams may be sewn in straight stitch or zig-zag.

- Bridles should be sewn, instead of simply tied on.

- It is best to use classics spinnaker fabric, also known as ripstop. It should be of medium weight - 35 to 50 gr. per m2 and as air-tight as possible.

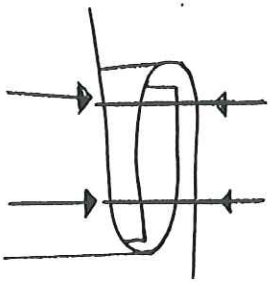


Kiters' meeting at MARSEILLE -(France)
Aerial photograph by Henri KOILSKI ©

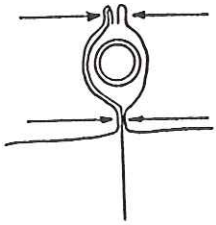
- Bridle points and spar pockets should be reinforced.
- The cuts of fabric should be assembled according to the diagram below

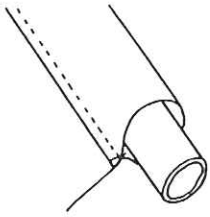
First seam

Second seam

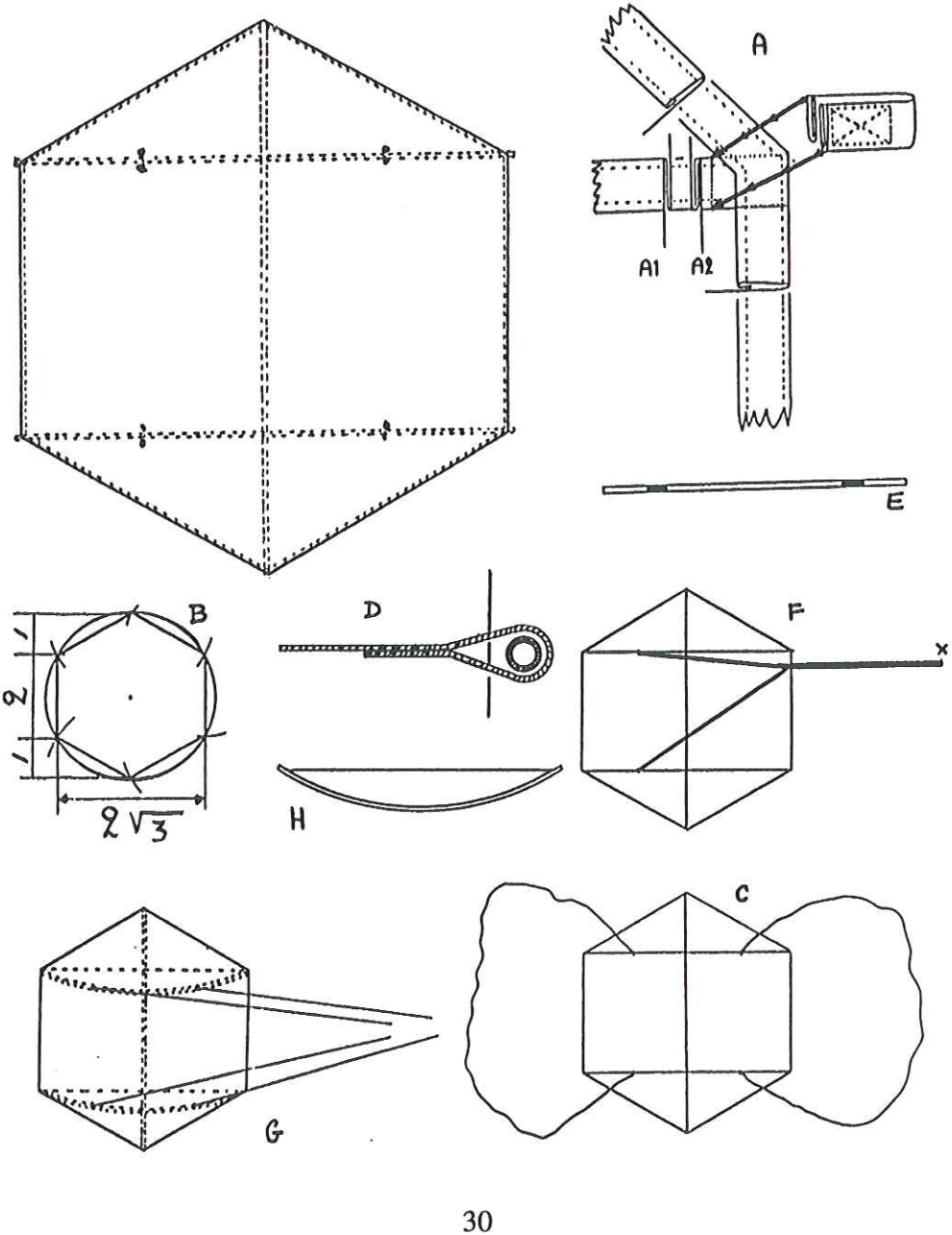


- The sleeves for delta kite spars should be made according to the diagram below :





Aerial photographs taken from a kite



Aerial photographs taken from a kite

ROKKAKU

Of course, the Sanjo Rokkaku, the traditional Japanese kite, is made simply of paper and bamboo (no ripstop fabric, nor glass fibre). There are several standard sizes, each based on the number of sheets of paper used to make it.

The basic sheet of washi (or "rice paper") measures less than 18X24 in. One sheet of paper is "kami ichi mai". A kite made with 30 sheets of paper is a 30-mai, a kite made with 50 sheets is a 50-mai, and so on.

Deviating from the scrupulous respect for tradition, the plan shown here is for a kite in the shape of a regular hexagon in a circle. The sizes recommended for our activities are 150 to 220 cm, to easily lift rigs of 400 to 1500 gr. The fabric used is spinnaker.

Although no traditional kite has exactly these proportions, we believe, after many tries, that this gives an excellent weight/surface ratio. The illustrations specific for this kite are commented below.

A. Detail of the seams, joints and reinforcements.

A1. Reinforcement using a double fold in the fabric.

A2. Joining two pieces of fabric while also creating a reinforcement

- The edges of the kite can also be hemmed by bending a ribbon along the edge to cover the two sides of the fabric.

B. Geometric principles of a hexagon within a circle.

C. Placing the bridles.

D. Attachment of the bridle through the kite and around the horizontal

spar. Bridles should preferably be sewn.

E. Detail showing where to join the spars when the length needed is more than the length available in one piece. The long part is in the centre and the two small parts are at each end of the central part.

F. Strapping point, in the shape of an X. Adjusting point a few centimetres below the top corner.

G. Bent kite, ready for flight.

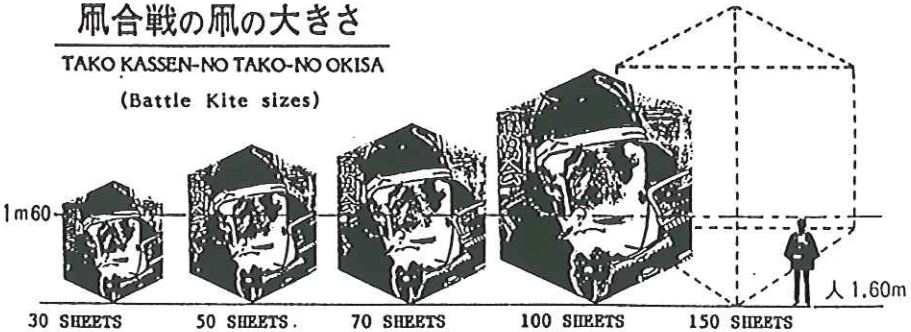
H. Back bending of the two horizontal spars.

The bridles for the flight and the straps for bending are in polyester, pre-stretched to avoid variations during flight.

凧合戦の凧の大きさ

TAKO KASSEN-NO TAKO-NO OKISA

(Battle Kite sizes)



30 SHEETS	50 SHEETS	70 SHEETS	100 SHEETS	150 SHEETS	
2.17 meters	2.85 meters	3.28 meters	4.25 meters	5.15 meters	HEIGHT
1.74 meters	2.12 meters	2.55 meters	3.22 meters	4.12 meters	WIDTH
2.83 sq m	4.53 sq m	6.27 sq m	10.26 sq m	15.91 sq m	AREA
7.12 feet	9.35 feet	10.76 feet	13.94 feet	16.90 feet	HEIGHT
5.71 feet	6.96 feet	8.37 feet	10.56 feet	13.52 feet	WIDTH
30.50 sq ft	48.80 sq ft	67.60 sq ft	110.40 sq ft	171.40 sq ft	AREA

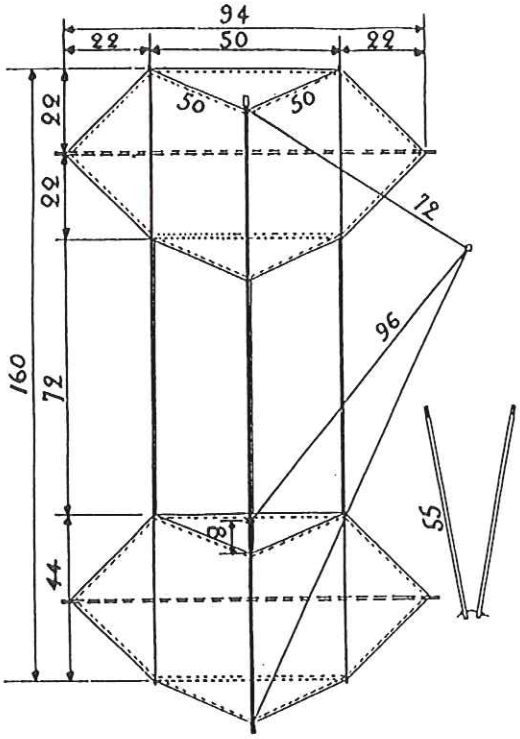
Leonard CONOVER

DUINBERGEN BEACH (Belgium)
Aerial photograph by kite by Jean LIENAUX ©

Aerial photographs taken from a kite

BROOK

The BROOK kite is particularly appropriate for strong to very strong winds. This cellular kite was invented by two Englishmen, Thomas and Walter BROOK at the beginning of the century and rediscovered by Jean LIENAUX.
The Penguin Book of Kites by David PELHAM shows, on pages 74 and 75, no less than 16 variations of cellular kites sold by BROOKITE Ltd. in the 1920's.
For the size shown, the spars are made of 8mm glass fibre, and the front one of 10mm.

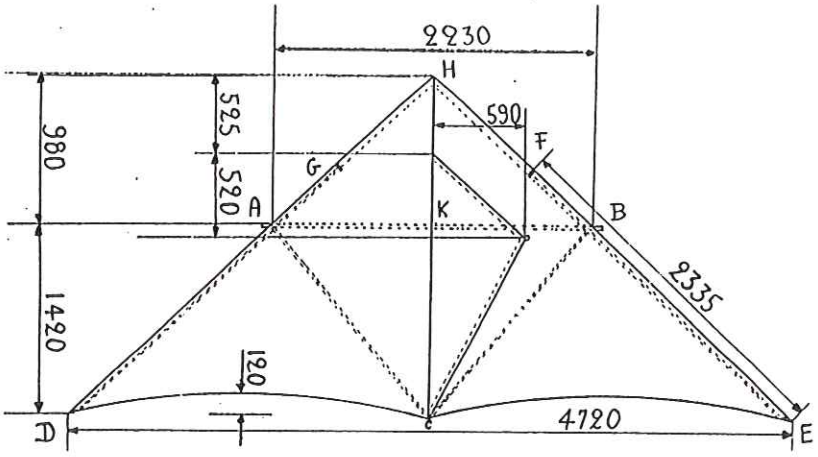


LARGE MORSE TYPE DELTA

Plan adapted from a plan by Jean LIENAUX published in KAPWA MAGAZINE N° Zero in October 1985

14 or 16mm HC - FE - DG glass fibre spar - 19mm AB glass fibre.

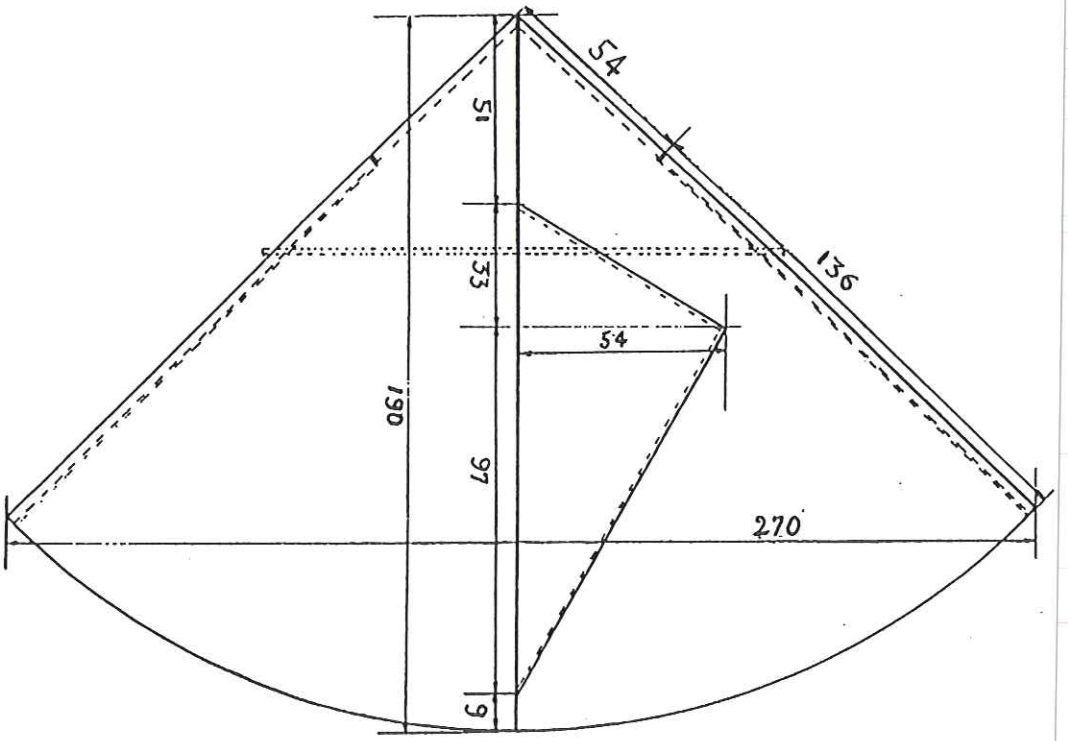
At K, a 20cm loop of ribbon limits the bending of the spar.



"STEAM" DELTA

This kite of French origin, was created by a "steaming" personality, hence its name. It is appropriate for low or very very low wind. It is unique for its very good weight/surface ratio. With a 4m version with a surface of 12.5 m2 and a 500 gr. rig it has been possible to take aerial photographs in absolutely no wind. The kite operator simply had to move at a speed of 5-8 km an hour !

The size shown here uses 14mm glass fibre for the vertical and horizontal spars. 10mm glass fibre is used on the edges of the wings.



Aerial photographs taken from a kite

FLYING LINES

In specialised shops, flying lines are classified by either their diameter, and/or their tensile strength (expressed in kilograms or pounds) or again by weight .

Basically there are two types of line, spun or braided, and for our purposes, only braided line is of interest.

Lines come in various material such as natural fibres (which should be avoided), or synthetics like polyamides, polyester, spectra, kevlar or similar. One important factor in the choice of line is the surface of the line presented to the wind. At equal tensile strength, the smallest possible diameter is preferable. Polyamide seems to present a good choice for its interesting price/quality ratio. This type of line is often used in diameters of 2-3 mm.

For stunt or manoeuvrable kites it is of importance that lines do not stretch, whereas for our purposes a certain elasticity and stretchability (1 or 2%) is preferable as it reduces the transmission of vibrations from kite and line to the rig and camera. Do not however try to use nylon fishing line, as it stretches too much and may then snap.

The prudent kite photographer will calculate with a tensile strength of 6 times the serviceable pulling force of the kite (see also page 27 about traction and weight of equipment).

Do not forget that knots will reduce the rated tensile strength of the line. Therefore it is preferable to zig-zag sow or stitch-on the various attachments over a length of 15-20 cms. rather than just tie them on.

If you are working with anything but the lightest equipment, it is important to take into consideration that with a strong pull on the line, it becomes dangerous to handle with your bare hands, so always take

along a pair of gloves.

It is not a good idea to wind the kite line on to the reel under tension. The added pressure of successive turns of line under pressure will add up to a pressure of several hundred kilograms on the centre of the reel which may end up breaking. The advised method consists in getting the line to the ground and then to wind it on to the reel without tension.

Kevlar line is extremely thin and extremely strong and will even cut through your leather gloves if you let it run through your hand. So it is to be used with extreme caution. And it is important to realise that if the line of one kite crosses that of another, it is always the thinner line that will end up cutting the thicker.

WHICH CAMERA TO USE ?

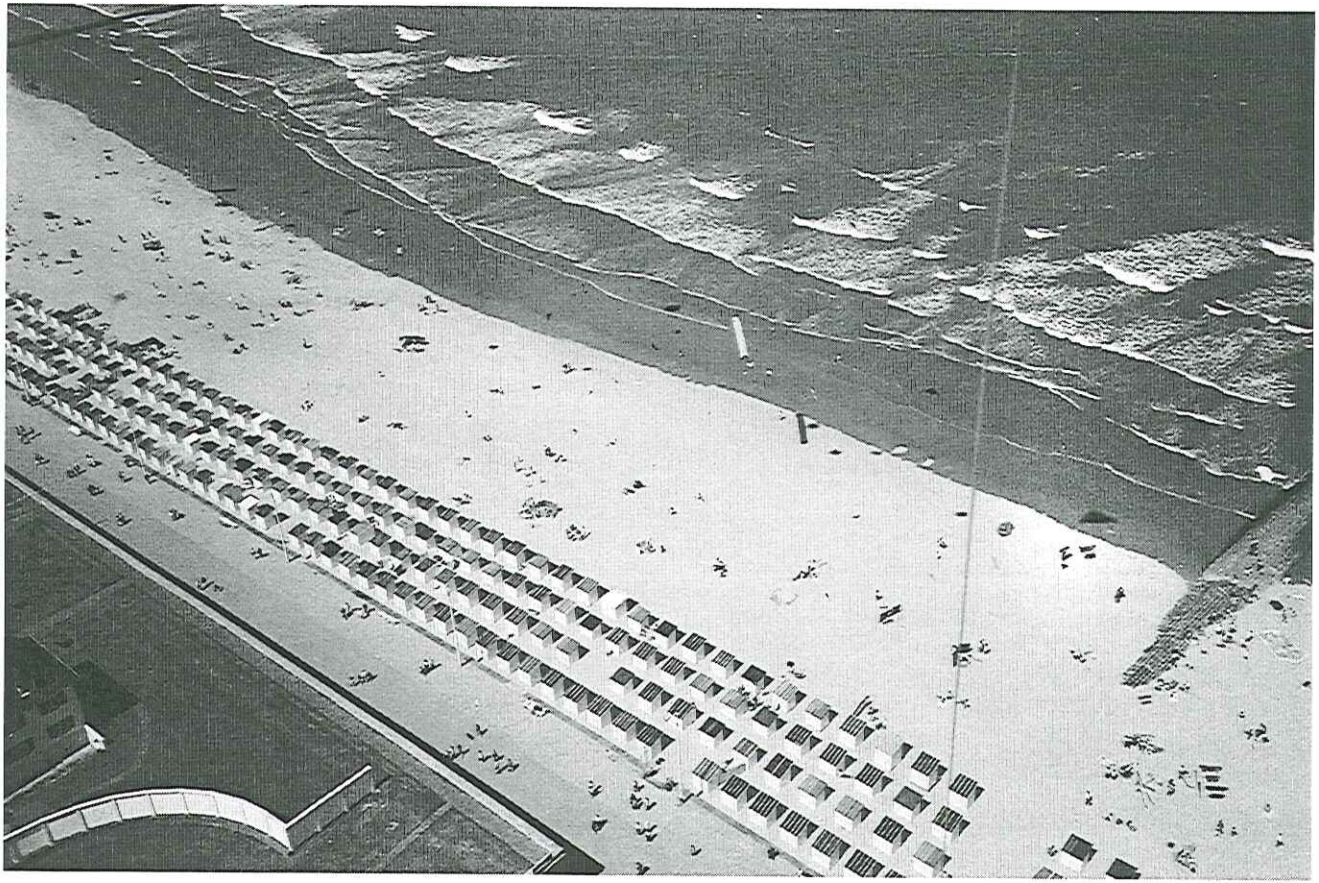
Which type of camera to choose and use for the most efficient kite photography work?

The camera you choose should preferably be light, with a wide angle lens and/or interchangeable (35mm or less for the 24X36 mm format) lens. It should have a minimum shutter speed of 1/250th and also, if possible, a winder and a built-in intervallometer. The latter greatly simplifies the triggering process. The most common formats are 24X36 and 6X6. Smaller formats produce pictures of insufficient detail.

Auto-focus is no advantage. If your camera has auto-focus, it should be de-activated and set to infinity if possible. For manual cameras, focusing must be set, and if possible blocked at infinity (use sticky tape to block the focusing ring, to prevent it from moving accidentally).

It goes without saying that you cannot expect good aerial photographs from a camera which does not produce good photographs during normal use on the ground. For your first tries, you should be rational in your choice. And it would be reasonable to start out with a medium quality compact camera with a good quality/price ratio. You can choose more expensive and better material later on, once you have gained some experience. For automatic cameras, fast shutter speeds can be obtained automatically by using a sufficiently fast film. (see chapter on choice of film)

"Single use or recyclable" cameras are not a good idea as their shutter speeds are too slow. They could possibly be used to enable beginners to gain confidence and experience, but they will not give good results regularly. As they are very light they are unstable (pushed by the wind) and it is sometimes a good idea to add weight.



OSTENDE Beach (Belgium) -
Aerial photograph by kite by Michel DUSARIEZ ©

FERRYBOAT "KNUDSHOVED" - Great Belt (Denmark)
Aerial photograph by kite by Lars R. LARSEN ©

Aerial photographs taken from a kite

WHICH FILM TO USE ?

Which film should you use to produce the best results in kite aerial photography ?

Firstly, you should know that basically there are two sorts of film: negative film, which are used for producing prints on paper, and reversible film which give a transparent positive picture known as a transparency or slide.

Both sorts of film can be used for producing inverted prints (paper prints using slides or slides using negatives) The quality of the results depend on how much you are prepared to spend.

Negative film has a wider exposure latitude, very useful for us, unlike the reversal film which will hardly tolerate any error. This must be taken into consideration when choosing the type of film, especially when using an automatic compact camera.

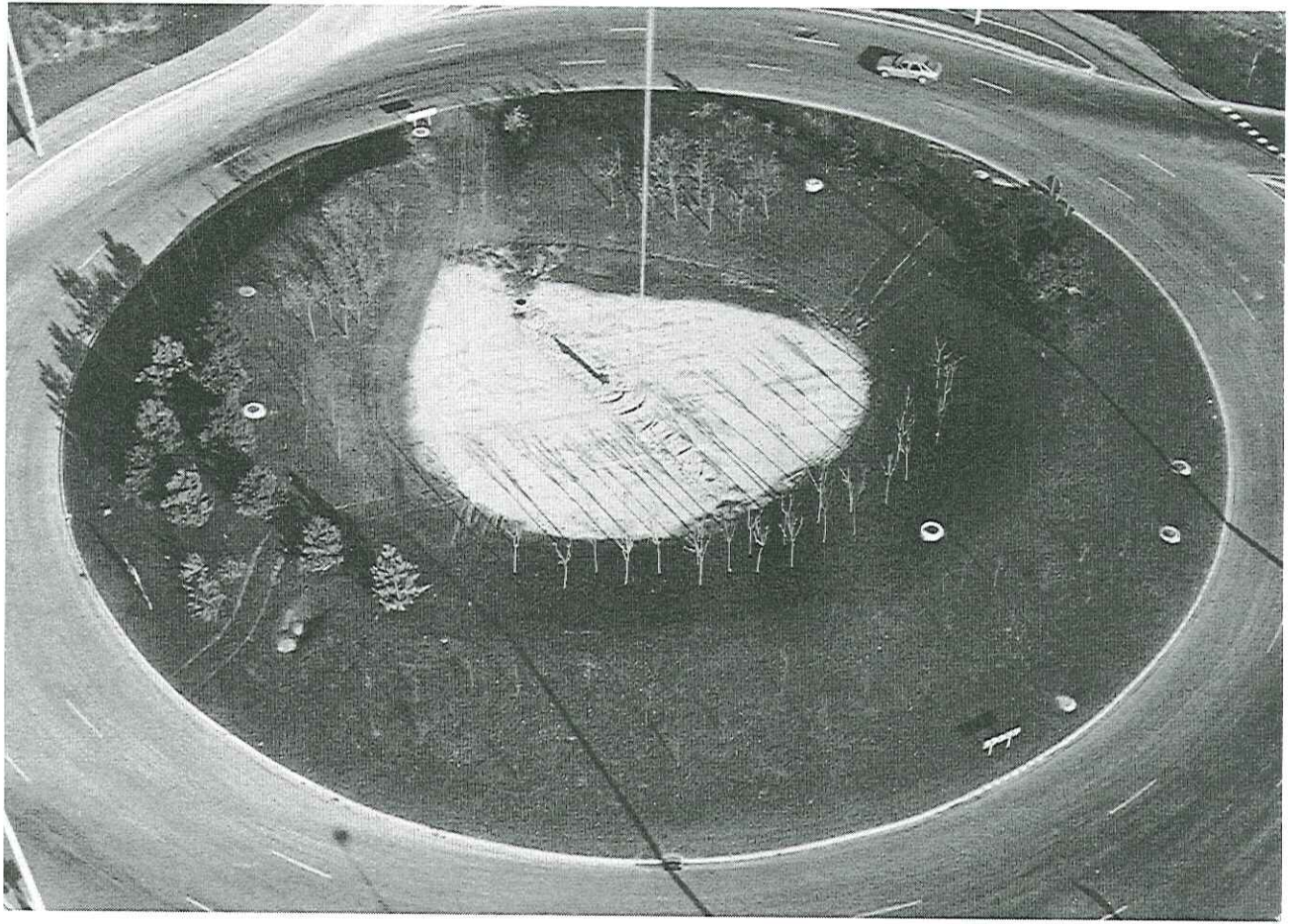
Before loading the camera, check that the film you use, falls within the range of the film speed setting, or in the case of cameras with automatic DX code indication, (grids with black and metallic squares on the sides of 35mm film cartridges) that the speed of the film you plan to use falls within the range of speeds recognised by your camera (see the instruction booklet).

Over the last few years, producers of photographic material all over the world have marketed products which have revolutionised principles which had been taken for granted for so long.

It was an established fact that the faster the film (permitting fast shutter speed and small aperture) the more visible the grain, even in small prints.

This is no longer completely true. Thanks to the absolutely revolutionary

progress made by chemists, a negative film like the FUJICOLOR 400 ASA or the newest KODAK EKTAR 400 will yield medium sized prints with no visible grain. This type of film seems to have become the usual reference film for most kite aerial photographers. Also, this type of film used in automatic cameras will force the programme to select the fastest shutter speed, which is exactly what we need for our activities.



Roundabout of the Route Nationale No 44 - Reims (France)
Aerial photograph by kite by Bernard MICHEL - Reims (France) ©

Entry of the Channel Tunnel - CALAIS (France)
Aerial photograph by José VALLOIS ©

Agricultural pattern by Jean-Pol GANEM
Aerial photograph by kite by Joël MATER - Bouconvillers (France) ©

HISTORY: HOW SHUTTERS WERE TRIGGERED.

Questions about how to activate the camera from a distance are certainly the ones which most puzzle those starting off in kite aerial photography.

How on earth do you activate a camera which hangs in the air from the line of a kite, tens or even hundreds of meters from the operator ?

You must, of course, use either a timing device or a remote control.

Let us look at this extract from the work of A. BATUT, printed in full at the end of this book. It describes his first experiments in the last century.

THE WICK - We have to choose between two modes of release, one elegant and ingenious which will allow us to operate the system at the precise moment considered favourable, but expensive, somewhat heavy and cumbersome: electricity. The other, simple, even primitive method will invariably function at the pre-set moment, regardless of whether the moment is ill-timed, either because the wind is falling, or because a cloud is masking the sun, but so light and so cheap that nothing else comes near it: it is the time fuse. It is this latter means of release that we prefer; and so much so that it is the one which we describe in detail. If, during our experiments, it sometimes operated untimely, we must concede that the wick never went out and that the release mechanism never came down without having been activated. Furthermore, its main advantage is its lightness. With electricity on the other hand, the two copper wires covered with silk or cotton, connecting the kite to the operator, will put a heavy burden on the tether line around which they are wrapped and thus, notably reduce the lifting power of the kite. Moreover, being less extensible than the tether line, they might snap when subjected to gusts, and the operator would remain helpless and without control over the apparatus. Finally, a battery and a contact button must be taken along by the operator and this excess of baggage

is most inconvenient when operating the kite. We repeat it, unless there are special circumstances, we prefer the time fuse.

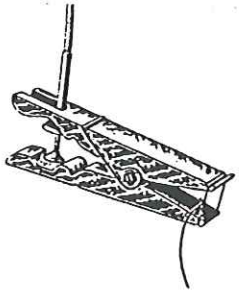
It seems that all veterans have used wicks, cigarette lighter wicks, or pyrotechnic fuses.

In all these systems, the shutter release is activated by an elastic string or a spring which is withheld by a fine cotton thread, which breaks when the ember of the burning wick reaches it.

Furthermore, we can quote this extract of an article which appeared in PHOTO-REVUE, 25th February 1912, which describes the use, so often rediscovered, of the clothes peg.

"In order to appear in the photograph myself, I use a wooden clothes peg. For a camera which has a rubber bulb, I use the clothes peg as it is. For a cable release, you have to make a cut of about one centimetre in one of the two jaws of the clothes peg. I fit the bulb or the cable release in the clothes peg and I keep it slightly open with a loop of ordinary thread which goes around the other end of the clothes peg. (see diagram). A length of about 30 centimetres of thread hangs from the loop.

Francis MAZIERE-France



To make it work, I light the free end of the thread and it starts to burn slowly. When the flame reaches the loop, the clothes peg is no longer held open, so it closes and activates the shutter release."

From 1890, Emile WENZ, from Reims, having acquainted himself with the work of A. BATUT, proceeded to do similar experiments, and as we know, with much success. E. WENZ also used either a wick or a second activating cable.
René DESCLEE (Belgium), who took no less than 124 pictures between 1910 and 1939, used only the wick. One of his pictures is printed below.

Severin MESSIAEN and René DESCLEE - 30th of July 1932 - Fixing of the camera and lighting of the wick. - Photograph by Jules MESSIAEN ©

It seems that many Belgian, French and even American veterans consistently used the wick.

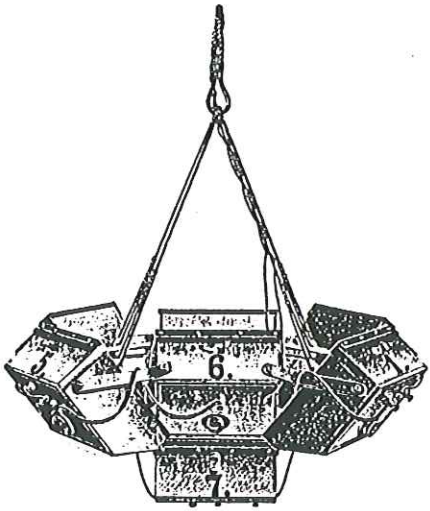
Aerial photographs taken from a kite

Most wick systems had a strip of paper or fabric which broke away when the shutter was released, so that the operator knew that the picture had been taken.

ELECTRICITY

In 1897 the Russian engineer R. THIELE created his Panoramagraph which had no less than 7 cameras, six positioned in a regular hexagon and slanted at an angle on the horizon. The seventh was at the centre of the hexagon and the axis of the lens is vertical.

The simultaneous activation of the whole thing was electric; a mercury electro-level, inserted in the circuit, would not permit shutter release, untill everything was perfectly level.



Aerial photographs taken from a kite

In 1913, J.Th.SACONNEY presented a description of his procedure in "METROPHOTOGRAPHIE". We reproduce the relevant extract about shutter release.

"Shutter release is activated by electric current. Two wires are required. With kites, the current travels by the main line, goes into the suspension through the runners and goes down to the camera through an insulated cable. It then leaves by a second cable which goes to the secondary line of the kite.

The high electrical resistance of thin steel cables and the increased resistance due to the pulling action demands a current of high voltage and low intensity.

A small hand cranked dynamo, is more suitable than a set of batteries.

The shutter release mechanism activated by an electromagnet is appropriate for the type of shutter used.

The electrical resistance of the electromagnet must be at least the same as that of the two steel cables, completely unwound and arranged in the relevant circuit.

In order to control the shutter release system, simply insert a light-bulb in the circuit, near the release switch.

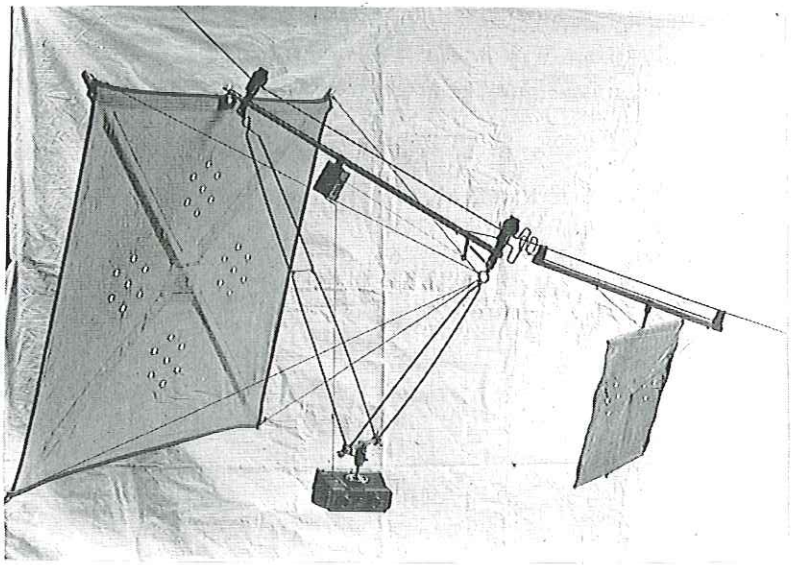
THE LINE CLIMBER

The device, known to the French under the more poetic denomination"postillon" was extremely popular at the beginning of the century and between the two world wars. It consisted of a little sail which went up the line to activate the shutter release and then came back down again.

Many patents were issued, among others those of José VINES and A. MEIFRED-DEVALS .

These were very widely distributed from 1910 by the Parisian aeronautical firm A.GOMES, under the name AEROPHOTO. The excellent performance of this aerophotography trolley and the fact that it was easy to use meant that it was copied more or less slavishly by numerous amateurs.

However, it no longer holds favour among our contemporaries.



ORIGINAL PLATE - Collection G. de BEAUFFORT ©

Aerial photographs taken from a kite

In June 1911, Jean AUBY published, in the magazine "LE CERF-VOLANT" (The Kite) a complete description of a line climber.

"Most cameras used in aerial photography are fitted with wicks, which are very impractical to use; in fact it is necessary to do experiments, first to know what length burns down in one minute, furthermore to know how long it takes the camera to reach a certain altitude, be it sent up by line climber or be it fixed directly to the kite, and these conditions vary according to wind force.

We have solved this problem in the following way :

1° Eliminate the wick completely

2° The camera will be pulled by a line climber which will bring it up to the kite.This way, knowing the approximate altitude of the kite, you will know the altitude at which the photograph is taken.

3° Once the line climber and the camera arrive at the end of the line they will activate the shutter release mechanism and, simultaneously, the coupling between the climber and the camera will be released, after which the camera will come back down, the picture taken. In this way it is possible to take several photographs without having to bring down the kite each time.

We think that the diagrams are sufficiently clear to be easily understood.

The camera is suspended in a triangular cradle which is very easy to make; this cradle slides up and down the main line of the kite on two eye bolts. These two eye bolts could be replaced by 2 pulleys (simply electricity insulators) which would reduce friction.

The camera is suspended in the cradle by a pin A. That way it always

remains vertical as long as the pin is not placed too far above the centre of gravity of the camera; in fact, if the pin is placed above the camera, it will sway too much.

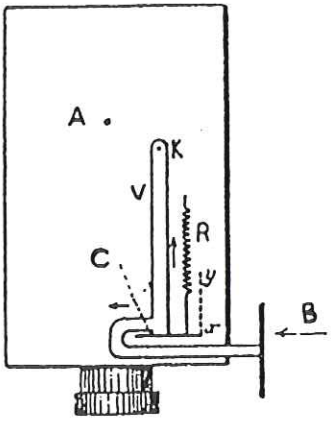
The illustration representing the camera represents a "detective" camera which is the most complicated case, because the shutter is released by pushing a cursor. A spring R is attached to the cursor C; the spring is held in a stretched position by a finger which can pivot around K, and the finger ends in a wooden or metal block, or even better, a buffer.

From the illustration it appears that if the buffer is pushed in the direction of the arrow, the finger will release the cursor, which will be pulled by the spring R, and trigger the shutter for the photograph to be taken.

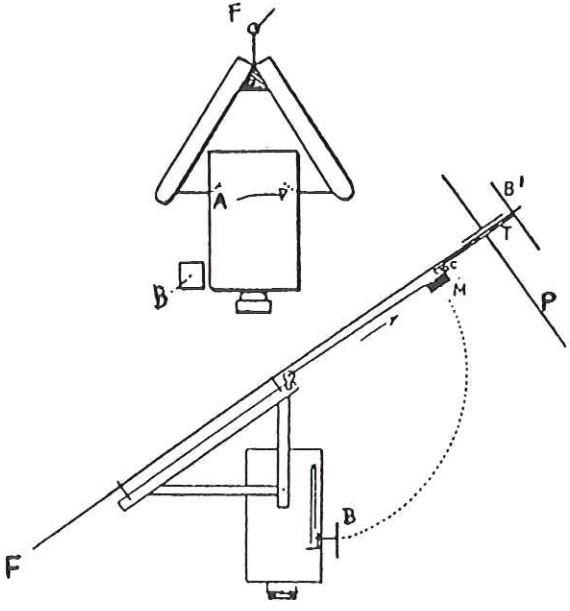
In the case of a "Folding" the device will be simpler because you simply press the rubber bulb to expose the plate. It is true that a "Detective" can also be provided with a rubber bulb.

The camera and its cradle are pulled by a sail P, which moves on the line on a sleeve T. A buffer B is fixed to the line near the kite.

Aerial photographs taken from a kite



A - pivotal points
B - buffer
C - cursor
F - kiteline
T - sleeve
P - sail
M - weight



Aerial photographs taken from a kite

Fixed to the sleeve T is a piece of metal sheet which ends in a hook c which, as can be seen from the diagram, is hooked to another metal plate on the end of a rod which is in turn attached to the camera cradle.

Thisis how it works. The climber arrives at the buffer at a certain speed and stops suddenly. Because of the inertia, the cradle continues, and the hooks c will come apart and the rod which connects the climber to the sail will drop and hit the camera buffer causing the shutter to be released. Also, as the camera and the cradle have been released from the line climber, they will come back down the line to the experimenter.

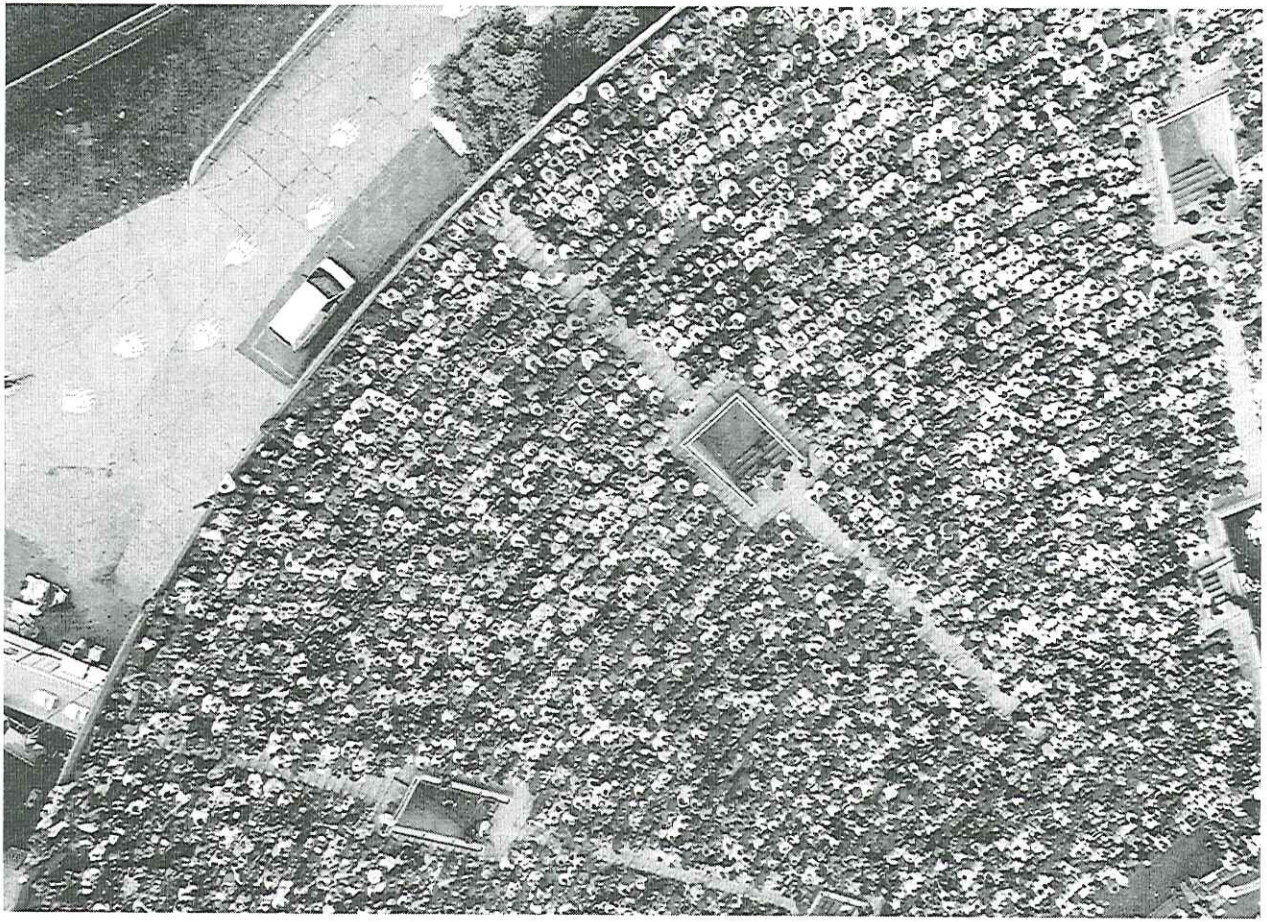
Note that :

1. A certain weight should be attached to the hook which links the camera to the climber in order to make a higher impact on the camera buffer.

2. The two hooks c should only have a very shallow opening so that the release works well. There is no danger of the cradle and the camera becoming unhooked from the climber as the latter will pull the whole rig with a constant force.

3. The sail P should have quite a large surface (proportional to the weight of the camera being pulled and inversely proportional to the wind force) so that the whole thing will arrive at the buffer B'. at a speed high enough to ensure the release. All there remains now is to wish the best of luck to those kite fliers who do us the honour of using our idea.

In the second edition of the book by Joseph LECORNU, "LES CERFS-VOLANTS" (1910) (KITES) we found a few paragraphs about shutter release systems. The following extract starts with the description of a method used by the American William A. EDDY, from BAYONNE (NEW-JERSEY) - U.S.A.



CAMP RANDALL STADIUM - MADISON - USA
Aerial photograph by kite by Craig WILSON -Wisconsin USA ©

Aerial photographs taken from a kite

The shutter was triggered by a little lead sinker, attached to an extra string which went down to the ground. But in the first tests, the releasing of the shutter shook the camera and the pictures were shaken. So, W.EDDY set about correcting this inconvenience by fixing the camera to a wooden structure to ensure that the camera was perfectly horizontal.

This question of activating the shutter is one of the most delicate in kite aerial photography; we have seen that, at least in their first experiments, Mr. BATUT and Mr.WENZ used a wick, or better, a pyrotechnic fuse which burned for a specific time: this is the simplest method and also the one most used by the veterans. Mr. DELCOURT, in France, Mr. GODERUS, in Belgium and many other experimenters managed very well with it, but there are many ways to activate the shutter release, for example, using a little clockwork, or using a line climber which moves up the kiteline and bumps against a buffer which activates the shutter release.

However, the most perfect method was that used in precision experiments and it consisted in releasing the shutter electrically, either getting the circuit to close by using a line climber, or using two metal cables going down to the ground.

Below an extract from the book "Les cerfs-Volants" by J. LECORNU.

... Electric shutter release has a considerable advantage in that it enables you to activate the shutter at the exact moment when the lens points at a pre-determined angle; without going into details of the methods for obtaining this result, we would simply say that they are based on the use of a little mercury level which only permits the current to pass when it is perfectly horizontal.

When you want to operate the camera, you close the circuit of the battery P using the switch L; but the current, which is sent to the shutter release mechanism D through the two cables C and C', must pass through the

mercury level M, and you can see that the circuit is only completely closed when the level of the mercury is the same in the two branches of the level.

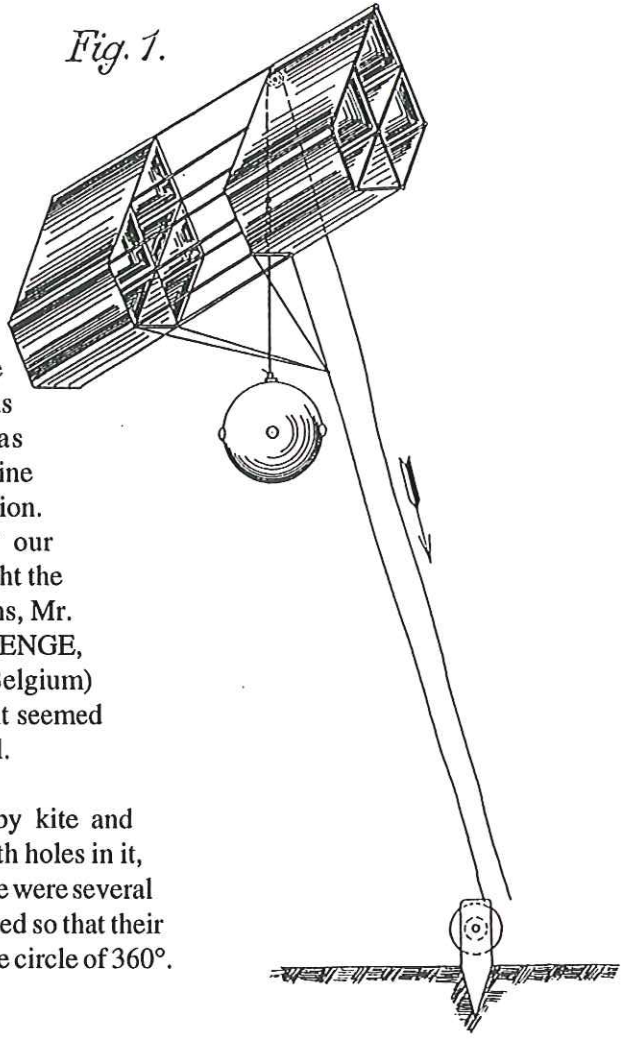
If you wish to take a photograph from a predetermined altitude, you can do like Mr. WENZ: insert a barometer needle into the circuit which comes into contact with a cursor which is set on a point of the face which corresponds to the desired altitude. As we see, electric mechanisms can be used in any possible combination.

M. ADAMS & D. BERGHMAN

Various members have sent us a selection of different objects and materials used for timers: macaroni, pharmaceutical capsules, suction cups, syringes, fresh- or salt water ice cubes, egg timers, water timers, etc.

Imagination seems to have no limits.

Fig. 1.



A FAR OUT INVENTION :

The photographic "sphere" from 1907

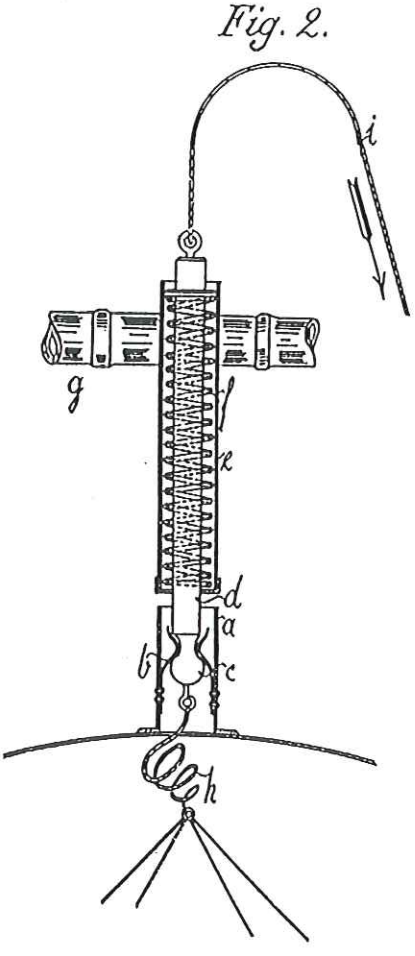
The ingenuity unleashed at the beginning of the century to trigger cameras lifted by kite, was sometimes on the borderline to the wildest of imagination. For the amusement of our readers we brought to light the invention of two Germans, Mr. BACHSTEIN and Mr. ENGE, patented in Brussels (Belgium) on 20th march 1907, as it seemed particularly .....original.

The device was lifted by kite and consisted of a sphere, with holes in it, and inside the sphere there were several cameras which were placed so that their lenses covered a complete circle of 360°.

In this way, by placing the photographs side by side, a panoramic view could be obtained. Using a mechanical control, the operator detached the "sphere" suspended from the kite and caused the simultaneous activation of the cameras during the "fall"... which was fortunately restrained by a line.

During the "fall", which was vertical, the pictures could thus be taken without any kite movements or cable vibrations affecting sharpness.

Was the photographic "sphere" experimented on in its time? What were the results? If history has kept a trace, no researcher has unearthed it so far.



LET US NOW LOOK AT THE PRACTICAL SIDE : "HOW TO ACTIVATE THE SHUTTER, ...NOWADAYS".

The built-in timer in most modern cameras rarely runs for more than 10 seconds. I have already resorted to this method when there was none other available or in order to gain a few grams weight; but because the delay is so short, it tends to produce aerial photographs which look as if they had been taken from the top of a ladder.

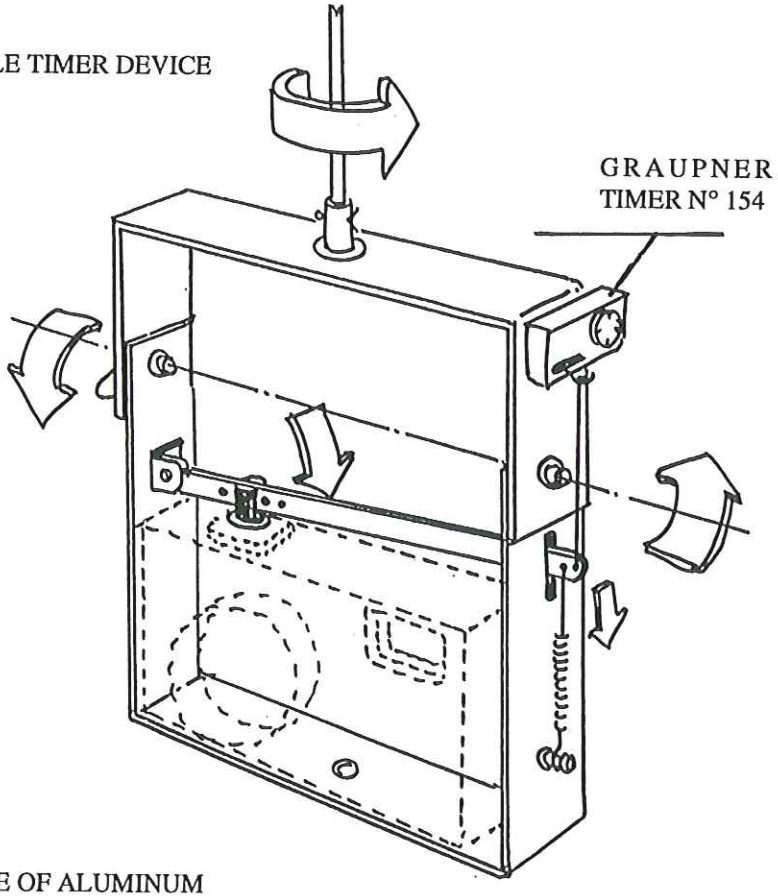
However, there are some "high-end" cameras, not always very light, which have or can be equipped with a "programme back" letting you decide when and at what intervals the shutter is to be released; an ideal solution but not necessarily the cheapest.

In order to be complete, we should mention a camera which is already famous in the world of kite aerial photography - the RICOH FF9. It has 6 shutter release programmes, one of which is specially designed for our activities, and as an extra, an electric shutter release socket. The special programme means you can have an automatic shutter release every 60 seconds. Realising that one minute is long enough for a kite to climb to an altitude of more than 100m, it is no exageration to say that this little marvel weighing only 230gr. is at the top of the hit parade of recent cameras.

Among the most used shutter release systems nowadays are systems which use the famous GRAUPNER n° 154 timer, which can certainly be recommended to beginners and which has a delay time of up to 6 minutes, and only weighs 16 gr. (available in shops which sell model aeroplanes).

The principle is based on its counteracting the pull of a spring or elastic band which in turn activates the shutter release mechanism when the timer goes off.

SIMPLE TIMER DEVICE



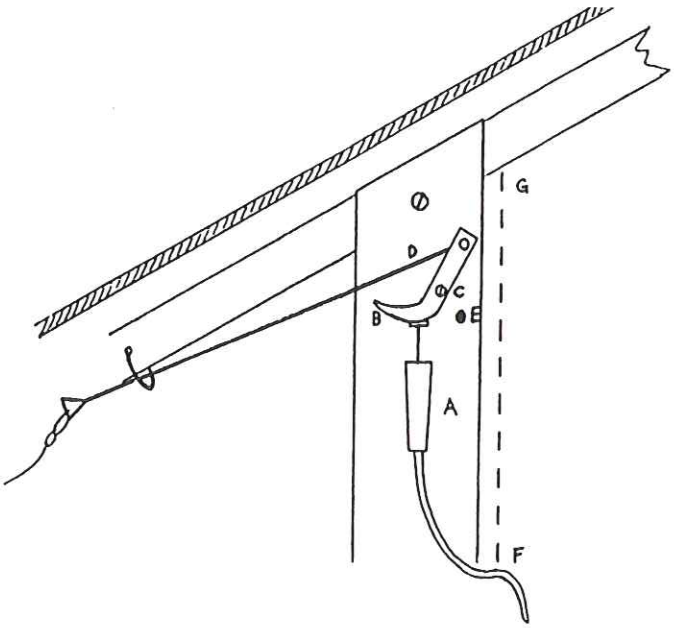
CRADLE OF ALUMINUM
PROFILE 20 X 2 MM.

All sorts of clockworks can be used, provided they are modified to suit our purposes.
The method of the second line is also easy to use. A cable release (A) is

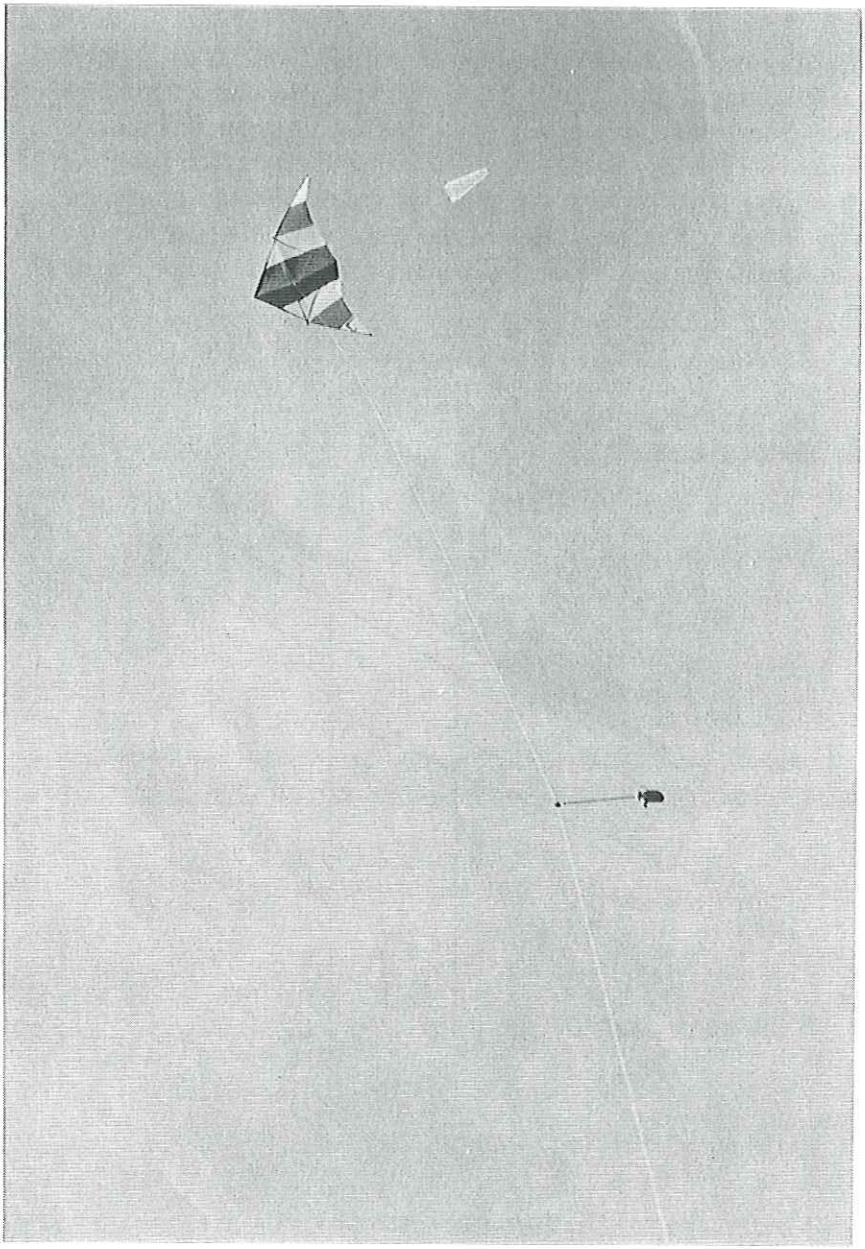
pushed by the curved lever (B) whose pivotal point is at (C). At (D) there is a metal arm (bicycle wheel spoke) to which the activating string which comes from below (the ground) is attached. (E) is a stopper for the arm B to prevent it going past the button of the cable release which would not be ready for the following photograph. I placed this mechanism near the main line to reduce the length of the lever arm (GF) and thus the pendulum movements, otherwise caused by the traction of the release line.

R. GUIDORI -Italy

RELEASE SYSTEM WITH A SECOND LINE



Aerial photographs taken from a kite



SYSTEM IN FLIGHT - © Collection KAPWA FOUNDATION©

HOW TO ATTACH THE RIG TO THE FLYING LINE ?

There are several possibilities for the amateur; but first of all, it would be a good idea to reject any method where the camera is directly attached to the structure of the kite.

Although such systems were used by the inventor at the start and by all the early pioneers of kite photography, they were abandoned for rigs attached to the line, at a certain distance from the kite.

There are two rival schools of thought here; one supports long suspension and the other yes, you've guessed, short suspension. It seems that most of our members nowadays use quite long and sometimes very long suspensions.

In addition there is the choice between flexible or rigid suspension. We will deal with this problem by reproducing an article by Pierre L. PICAVET, printed in the REVUE DU CERF-VOLANT (THE KITE REVIEW) of October 1912.

This method, adapted to modern materials, is favoured by some of our most successful correspondents.

PENDULAR ELLIPTICAL SUSPENSION - presented in REVUE DU CERF-VOLANT - NOV 1912.

The desire to have a perfectly sharp negative makes the kite photographer opt for pendular suspension. In fact, attaching the camera directly to the kiteline, either using a rod or a triangle like that of Mr. LECORNU, will only lead to problems, as the vibrations of the line will be felt unless shutter time is very fast, which again requires lenses with large apertures which again are very expensive.

Aerial photographs taken from a kite

Let us take a look at existing pendular suspensions which have yielded good results: those of Capitain Saconney.

We will leave out the most recent as it is too complicated to construct, but we maintain the flexible elliptical Saconney suspension, as used by Mr. Aubry. The suspension that we use derives from it.

We attach it directly to the kiteline, this way, only one kite and only one line are needed.

The camera cradle is a double bracket which permits the camera to pivot around its centre of gravity. Two winged bolts through the sides, on the gravity axis, allow the camera to be fixed in any position and make it turn a semi-circle around the horizontal axis The cradle is fixed in the middle, to a cross, by another winged bolt which allow a 360° rotation around the vertical axis.

The cross is made of 2.5 cm X 1cm wood, with a metal eye at each of the 4 ends. The rods are 71cm long ; In the middle they are carved out to 2/ 3 of their thickness, in order to be fixed easily to the cradle. The side of the square thus formed measures 50 cm.

The suspension is made of one single length of string with a diameter of 1.5 mm and a length of 18m. One of the ends is fixed to the ring A, and with the cross open, it is passed successively through the rings A and B and the 4 metal eyes in the following order : A,1,B,4,A,2,B,3,A; then the two cable ends are tied together at A. This gives the rig presented in the diagramme. It suffices to attach A and B at two fixed points and to make the cross horizontal; this stops the four strands at A and B.

This suspension is elliptical, as the sum of the lengths of two strands running through one of the metal eyes is always equal to a quarter of the total length of the string. So, the surface CD will always remain horizontal.

Aerial photographs taken from a kite

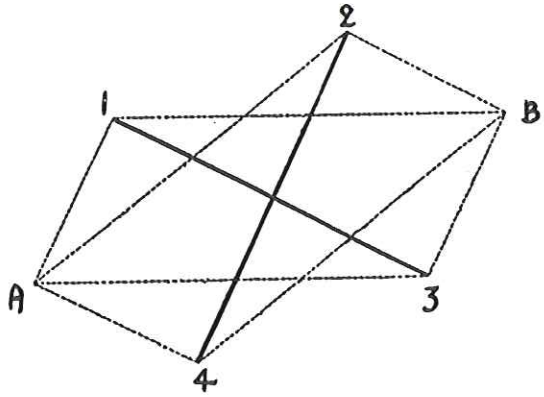
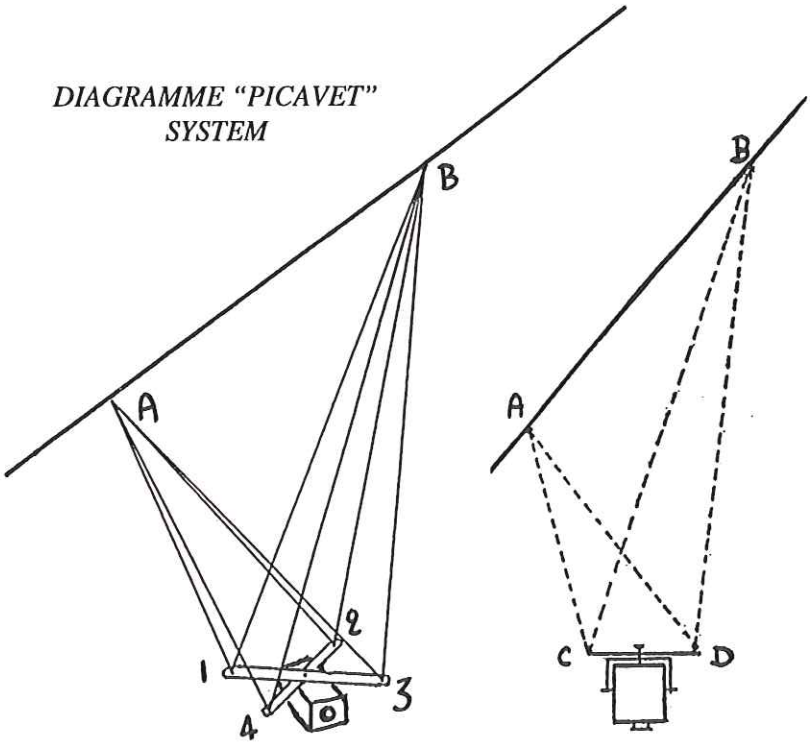


DIAGRAMME "PICAVET" SYSTEM



Aerial photographs taken from a kite

Two toggles fixed on the line can be used to hold the rings A and B. One of the advantages of the suspension is its extreme lightness, for, with the cradle, it hardly weighs 400gr. Given the long length of the pendulum (about 2m) the lateral movements are very slow ; as for the longitudinal movements, they are quickly absorbed by the friction of the cables in the metal rings. It would be a good idea to use 4 little pulleys instead of metal rings, but we make do with this rudimentary device.

Photographs at 1/100th are very satisfactory and hence you can use inexpensive lenses. The price of the suspension itself is very modest.

The accomplishment of good photographs of a given object is very easy. We hope that this suspension will tempt a few kite fliers and we are certain that it will be very helpful.

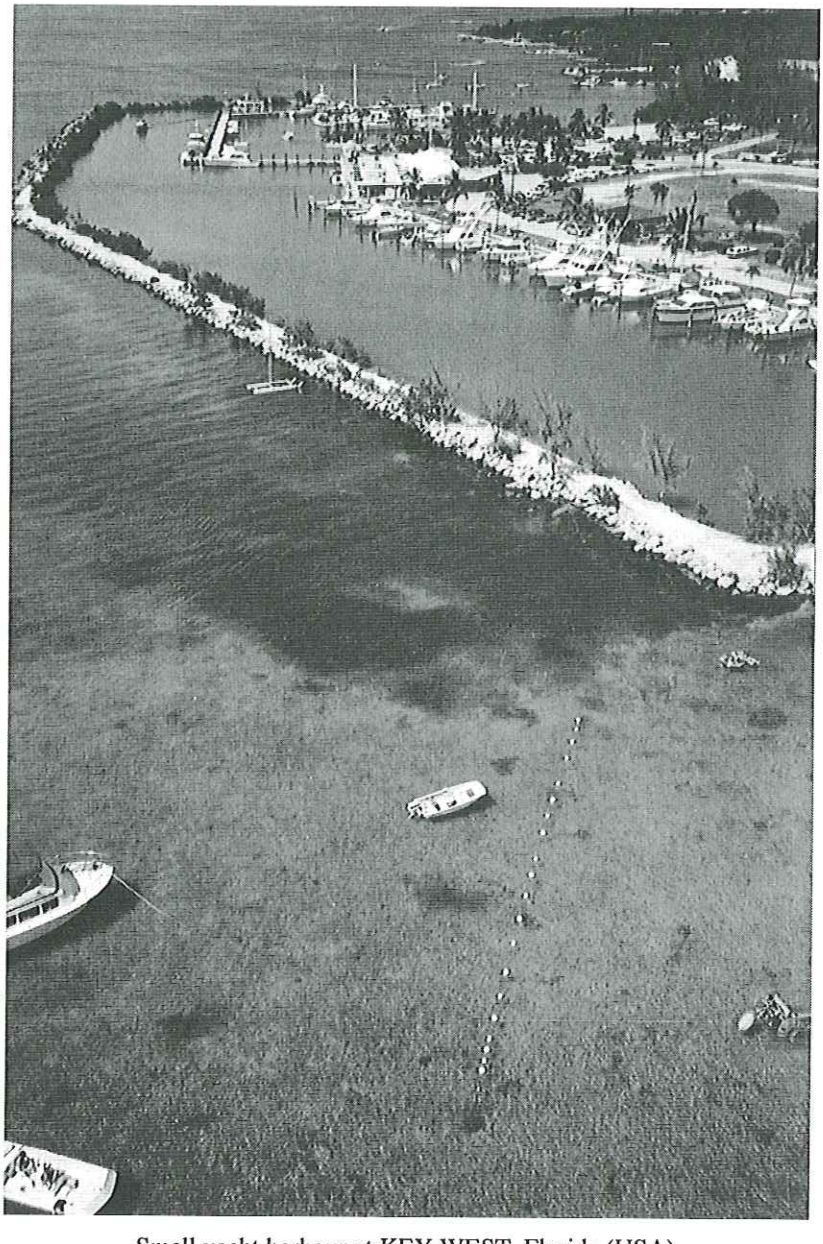
PIERRE L. PICAVET - NOV. 1912.

Another system which gives excellent results and which has stood the test of time is the pendular system where the cradle that carries the camera, fitted with a directional system, if so desired, is attached to the kite line, a few dozen metres from the kite; it consists of a rod, made of rigid material, preferably non-metallic, a little less than a metre long.

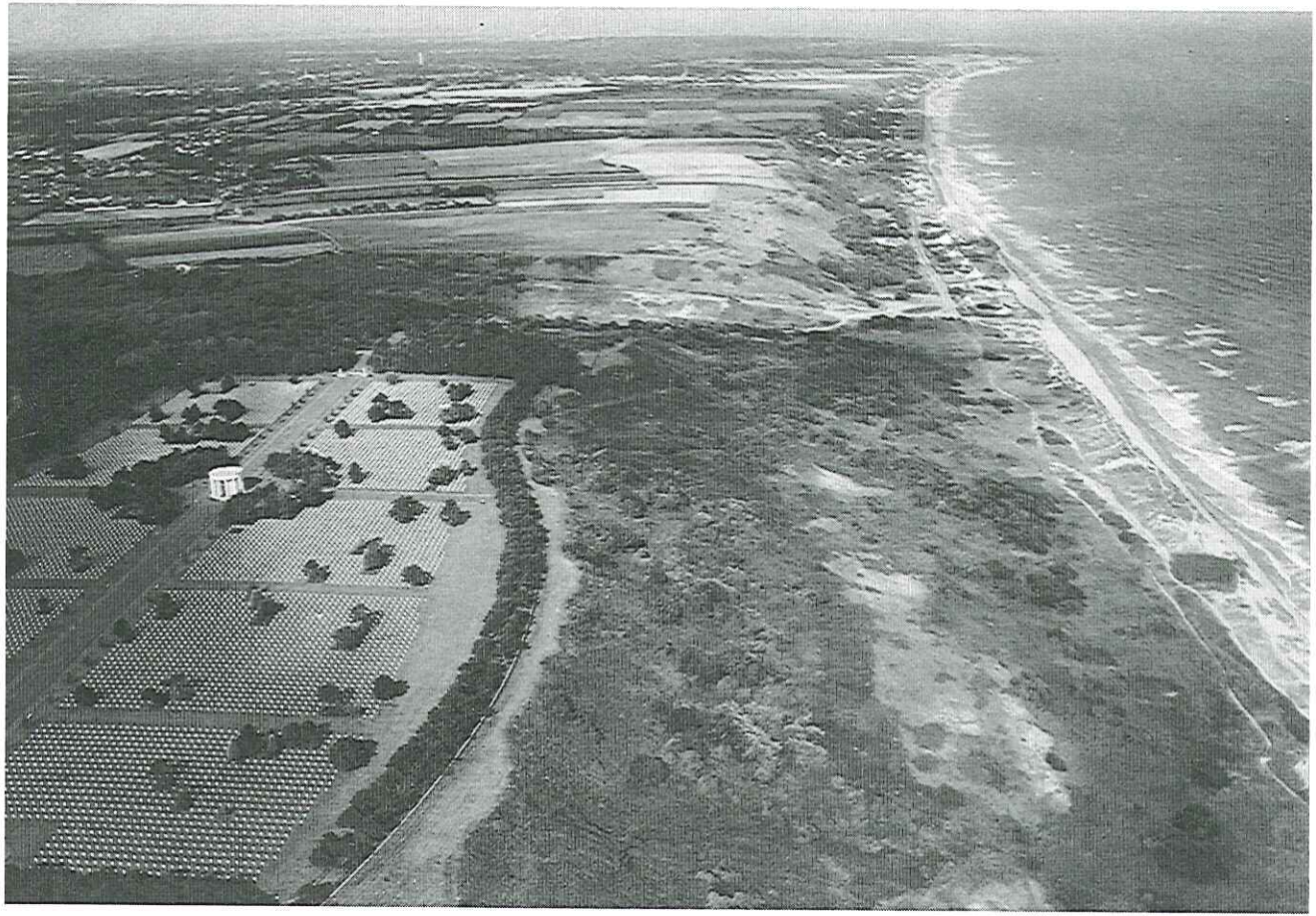
Some aerial photographers do recommend longer pendulums, even much longer. In our opinion, however, the small advantage in stability does not outweigh the problems of handling caused by such great lengths.

This rod, hollow or solid, in bamboo or glass or even carbon fibre, is attached to the centre of the backbone, a metal profile or wooden rod, about 30 cm long, using a metal bolt, to enable the pendulum to hang vertically. Swinging will be braked by a rubber ring set between the stem of the pendulum and the backbone. Where they are drilled, hollow rods should be plugged with a wooden plug, glued with epoxy resin glue, and

Aerial photographs taken from a kite



Small yacht harbour at KEY WEST, Florida (USA)
Aerial photograph by kite by Michel DUSARIEZ ©



AMERICAN MEMORIAL CEMETERY - OMAHA BEACH - Normandy (France) 9386 graves.
Aerial photograph by kite by Dany HEEREN - Mont st. André (Belgium) ©

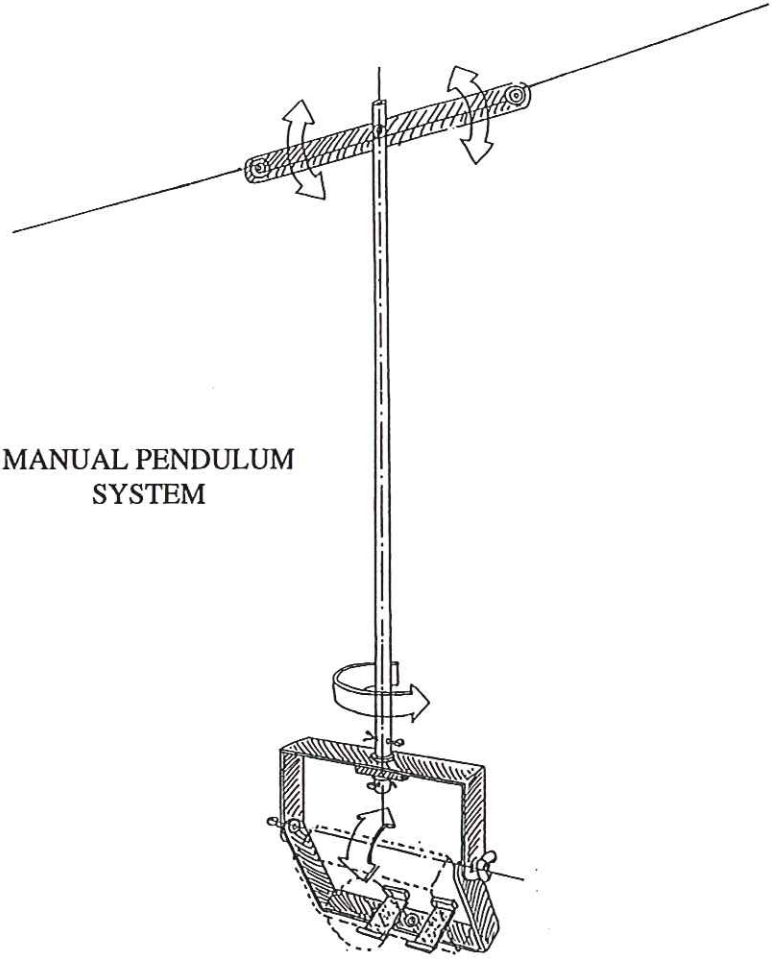
Aerial photographs taken from a kite

WELLS Harbour - Norfolk (England)
Aerial Photograph by kite by Trevor DEARY ©

reinforced with a sleeve, which is also glued.

At each end of the backbone is a knob, like a drawer's knob, around which you make two loops to attach it to the kiteline.

Any similar gadget will do the trick. Do not hesitate to use your imagination.



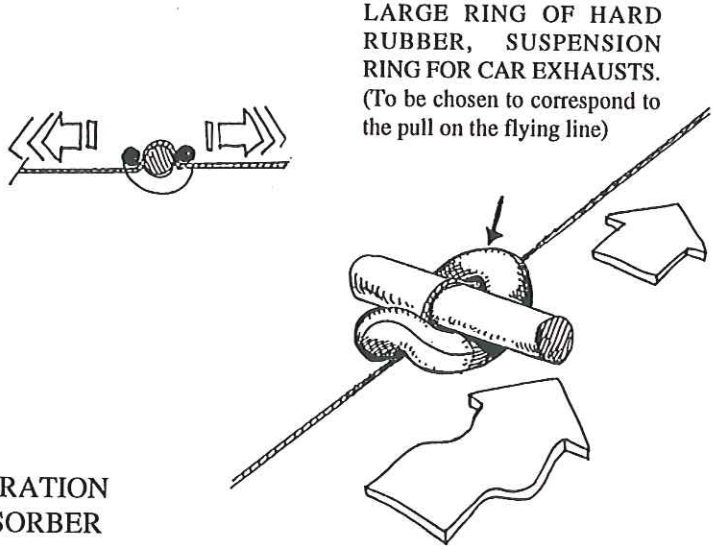
MANUAL PENDULUM SYSTEM

Aerial photographs taken from a kite

In order to get photos which are as sharp as possible, it is essential that no part of the suspension rig contains elements of which play could cause rotational movements of the whole rig or any part of it, be it ever so small.

Always remember that vibrations caused by the kite and transmitted by the line, can undo the most carefully built rigs. You can buy self-locking nuts and also products which bind screwed connections.
A safety line, connecting camera and kiteline, is strongly advised to avoid losing the camera, if one of the pendulum elements should break or simply detach itself.

Apart from the risk of the rig breaking apart because of vibrations, these could also impede the proper functioning of the camera. Illustrated below is a way of almost completely eliminating them. This accessory is not really essential, but we do recommend it.



Eric REGOUT - Belgique

RADIO-CONTROLLED SHUTTER RELEASE

Sooner or later, the search for ease and comfort quite naturally induce most kite photographers to use radio control to trigger the shutter release and furthermore to turn the camera.

In fact, radio controlled shutter release is a must in all situations where the operator wants absolute control over the moment when the shutter is triggered, be it because the camera hangs perfectly still in the sky, or be it because the scene to be photographed should be immortalised at a precise moment.

The combination of a camera with a winder and the radio control allows you to take a whole film in a couple of minutes.

Radio control systems for scale models have all the qualities necessary for us.

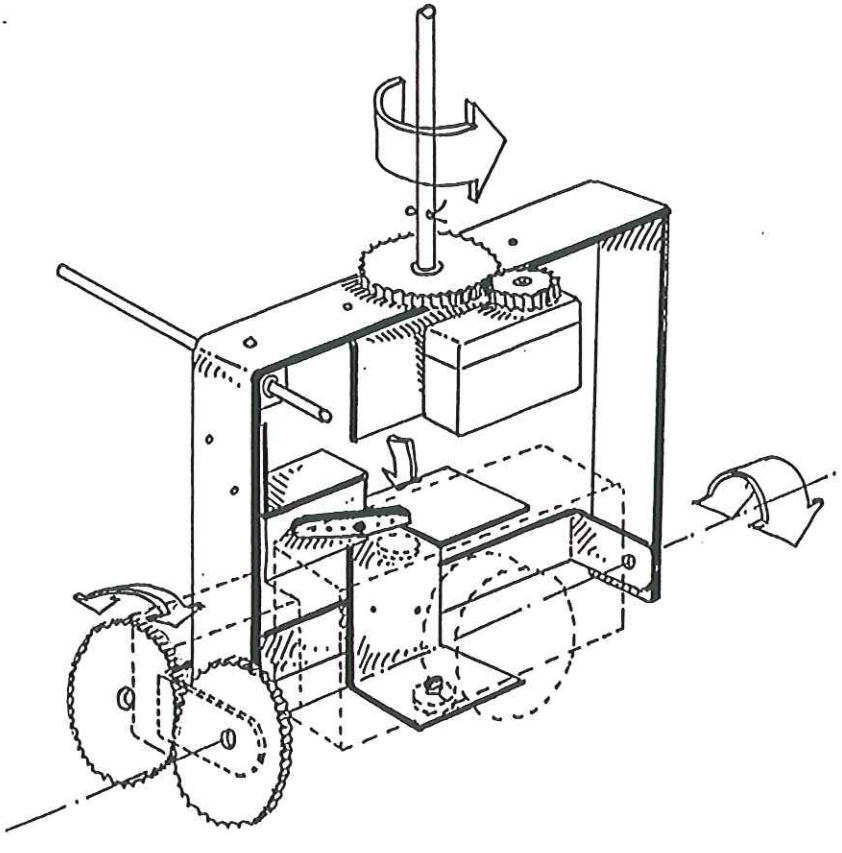
The price of different units consisting of a transmitter, a receiver and a variable number of servos differs mainly according to the number of operations you can do.

Each control activates a servo, a small geared-down motor, pushing with a certain force, a small lever through about 90°.

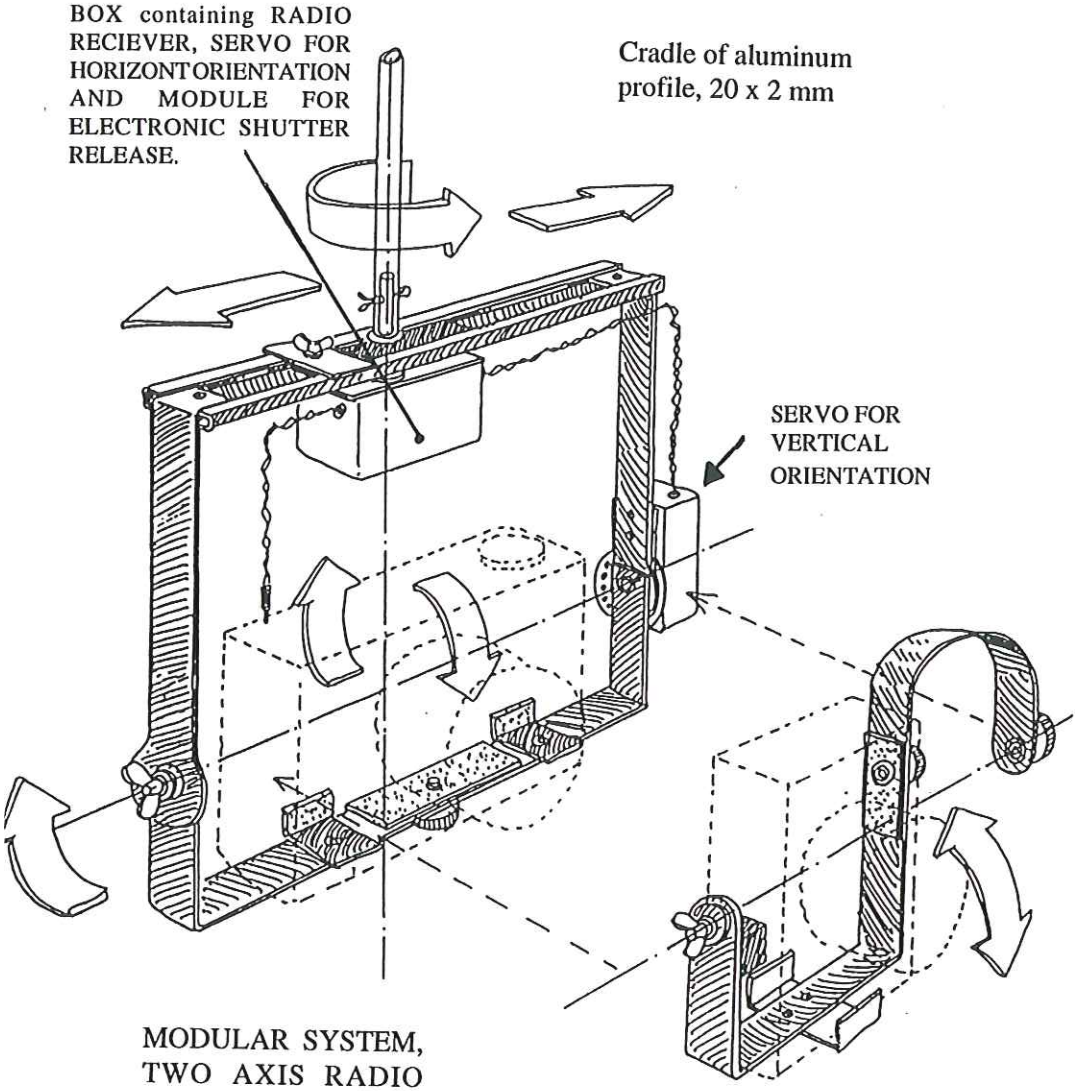
A control for 3 servos seems the most appropriate for our activities, even if, in the beginning you were to use only one or two servos.

However, a "3 servo" unit will be a bit more than twice the price of a "2 servo" unit.

Careful ! There is a slight ambiguity here: 2 channels does not mean 2 servos, but 1 servo giving 45° in each direction, so 4 channels means 2 servos, etc.



RADIO CONTROLLED TWO-AXIS SYSTEM
Cradle of aluminum profile, 20 x 2 mm



MODULAR SYSTEM, TWO AXIS RADIO CONTROLLED

The useful range of these systems is largely sufficient, on the absolute condition that you use new, well-charged batteries in both transmitter and receiver. It is preferable to choose systems which allow you to use either traditional batteries (do use the best ones) or rechargeable (NiCad) batteries.

In early days of the NiCads, the drawback with rechargeables was that you did not know how charged they were; if the operator only found out in the field that they were insufficiently charged, and if he had no extra power source, he would have had have to pack up and go home. But later generations of NiCads and their electronic chargers have overcome that problem, by completely discharging the batteries before re-charging.

Insufficiently charged batteries might fool you, as they might provide power enough to work correctly at short range but would not suffice for the longer distances usually used.

Be careful also in low temperatures; they strongly reduce battery performance, whether they are classic or rechargeable.

Another problem, you might encounter, is that the reciever might get jammed by parasitic radio wawes (portable telephones etc) and then exhibit anarchic behaviour with untimely camera turns and shutter releases. The aerials should be pulled out completely and used that way.

Radio controls have specific wavelengths, attributed in each country to each group of users. You should get information on this either from the authorities or from competent vendors. In some countries there is an annual tax to pay, so you should find out.

360° ROTATION

Eric STEMPEL - France.

Since a servo-control has a useful angle of 90° to 95° only, a 360° rotation of the cradle and the camera is only possible by an up-gearing of the last level of the servo.

A servo-control consists of an electronic part controlling a motor which activates a set of reduction gears and an exit, usually an axle turning 45° in each direction.

Inside the housing, the exit axle of the servo ends in a potentiometer which scrupulously follows the orders given by the transmitter, as the potentiometer axle is the same as the exit axle. If we were to cut that axle, the servo control would behave like a classic, geared-down motor, working as required in both directions.

A word of warning: opening the servo will cancel the guarantee. You need a minimum of dexterity, a good low power soldering iron, 30 watts maximum with a very fine point and a basic knowledge of electronics.

- Take the servo apart (careful with the gears ! Note their position, so that you can put them back again).

- Remove the electronic part.

- Unsolder the three potentiometer wires (note the colours) from the printboard after noting their place.

- Resolder in the same holes of the printboard, the three cables of a small potentiometer of the same value as the potentiometer removed. (which you will have measured).

- Remove the mechanical stops of the old potentiometer or take it out, if it is not an integral part of the axle of the servo.

- Close the servo leaving the electronics on the outside. Connect the servo to the receiver.

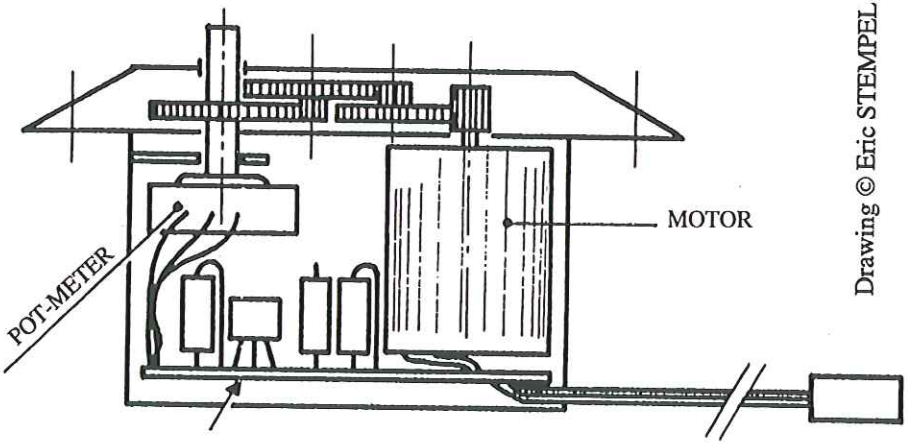
- Turn on the transmitter and the receiver. If all has gone well, the servo now should turn continuously in one direction.

- Without touching the transmitter, adjust the new variable potentiometer so that the rotation of the servo stops.

- The electronic part is protected by a little bag or plastic box and fixed to the body of the servo.

- By activating the lever for the servo on the transmitter, you can obtain continuous rotation in one direction or the other as desired (on the transmitter the lever must have an automatic return or neutral, which for scale models is the direction control lever).

Now you have a reversible continuous rotation servo with the possibility to stop anywhere in 360°.



Windmills at KINDERDIJK - (The Netherlands) -
Aerial photograph by kite by Antoine VARIN - (France) ©

TRANSFORMATION FOR A REVOLUTION, STEP BY STEP

In the following we describe a different version over the same theme

By using a servo transformed according to the instructions below, you will be able to know, at any given moment, the direction of your camera without having to search the skies to look at it.

The modification described below enables you to cover a little more than 360°, furthermore, to turn the camera in both directions and at the same time to control the exact direction from the ground.

You have to separate the potentiometer from the exit axle (there is a potentiometer in every servo) and to gear it down by a ratio of 5.
The exit axle of the servo must be provided with a cogwheel of a very small diameter (5 to 6 mm) which meshes with a larger one (5 times more teeth) which sits on the axle of the potentiometer of the modified servo..

The modification can be partially internal or totally external. The original potentiometer can be used, in which case, it must be removed from the servo-box to be fitted with the larger cogwheel. Or it can be left in place, in which case it must be disconnected electrically a n d mechanically. In that case it important to note or to measure the exact Ω value of the internal potentiometer in order to find one of exactly the same value in a specialised shop. If necessary you should ask a specialist in electronics, radio or television .

Before unsoldering the three wires of the potentiometer, it is a good idea to note carefully the order and colours.

All that remains now is to also modify the part of the transmitter that

sends to our transformed servo.

It should be provided with a new potentiometer with a pointer button and a scale going from 0° to 360° Without having to look at the camera in the sky you can now know the direction in which it is pointing.

In order to point the camera where you want to take photographs, you should have a reference direction, for example the direction of the transmitter aerial parallel to the line, facing the kite.

Lighthouse - (France)
Aerial photograph by kite by Antoine VARIN - (France) ©

Antoine VARIN - France.

TO AIM, WHICH INCLINATION TO CHOOSE?

The answer is on the horizon.

Chapter adapted from a study by Antoine VARIN - France.

An aerial photograph does not give the same impression when it shows the horizon as when it does not. Unconsciously, one is conditioned by the horizon in a picture:

- At the horizon the field of vision is maximum (notion of environment possible)

-At the horizon aerial and terrestrial vision merge (notion of recognition is possible)

-At the horizon, details are lost in the totality (notion of synthesis possible).

So, dealing with the same subject, photographed from the same point (constant altitude), it is possible to produce totally different pictures which would be of a totally different interest. It simply depends on the inclination of the optical axis at the moment the photo is taken.

Generally, the choice is limited to one of the three following possibilities;

1) The horizon is visible on the photo. The foreground is incomplete or inexistant, all details of the ground are very far away, the background is clearly visible, with a band of sky visible above the horizon.

2) There is a suggestion of the horizon on the photo. The foreground is visible and identifiable, all details

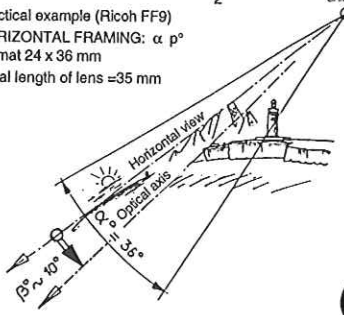
ANGLE OF TILT CHOSEN	IMAGE OBTAINED

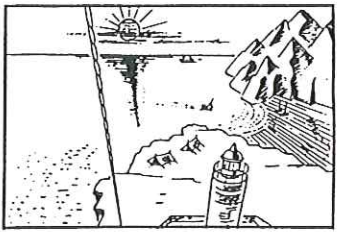
$\alpha°$ = field of view of lens

$\beta°$ = angle of tilt of the optical axis to the horizon

THEORETICAL FORMULA: $\beta° < \frac{\alpha°}{2}$

Practical example (Ricoh FF9)
HORIZONTAL FRAMING: α p°
Format 24 x 36 mm
Focal length of lens =35 mm

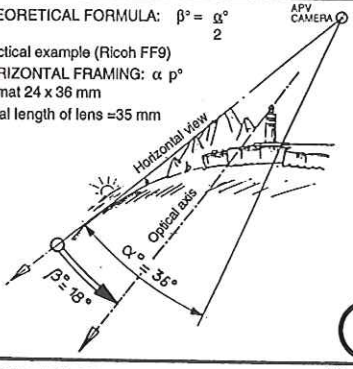


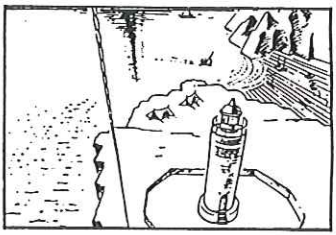


1

THEORETICAL FORMULA: $\beta° = \frac{\alpha°}{2}$

Practical example (Ricoh FF9)
HORIZONTAL FRAMING: α p°
Format 24 x 36 mm
Focal length of lens =35 mm

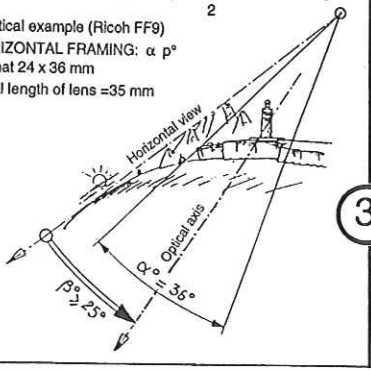


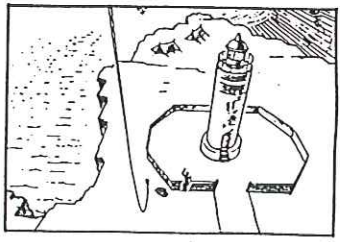


2

THEORETICAL FORMULA: $\beta° > \frac{\alpha°}{2}$

Practical example (Ricoh FF9)
HORIZONTAL FRAMING: α p°
Format 24 x 36 mm
Focal length of lens =35 mm





3

DRAWINGS AND TABLES
© Antoine VARIN - FRANCE

Table 1

seen on the ground are discernible and the background is clearly visible out to the horizon.

3) The horizon does not appear on the photo. The foreground is very much in presence, all objects on the ground are very detailed and background is nonexistent.

Based on good photographic conditions, table (1) shows the advantages and disadvantages, for each inclination, of each picture taken. However, to better treat practical problems encountered in the field, some of the above information demands further explanation.
Here are some important details to remember :

1- The lens and its field of vision

Some people use other lenses than the example chosen, or use the camera in the upright position.
So here are some supplementary figures (see table (2))

However, be careful! Mistakes are easily made, because more often than not, lens manufacturers state field of vision as measured on the diagonal of the frame (..."D) fig. (3).

But, before being applicable, this angle (..."D) must be transposed, taking into account whether the larger side is horizontal or vertical.

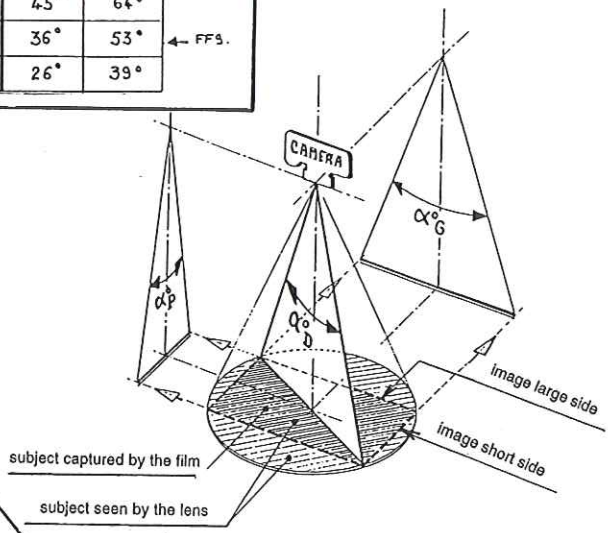
- either ..."D means ..."p (if the picture is composed large side horizontal, see fig.(3)).

- or ..."D means ..."G (if the picture is composed large side vertical, see fig (3))

Table 2

Focal lengths	Field of view in degrees			
		Film 24 x 36 mm		
	$\alpha°_D$	$\alpha°_H$	$\alpha°_V$	
20 mm	94°	61°	83°	
24 mm	84°	53°	73°	
28 mm	74°	45°	64°	
35 mm	62°	36°	53°	← FFS.
50 mm	46°	26°	39°	

fig. 3



$\alpha°$ D = THEORETICAL FIELD OF VIEW - diagonal of negative
$\alpha°$ G = REAL FIELD OF VIEW (image large side)
$\alpha°$ P = REAL FIELD OF VIEW (image short side)

fig. 4

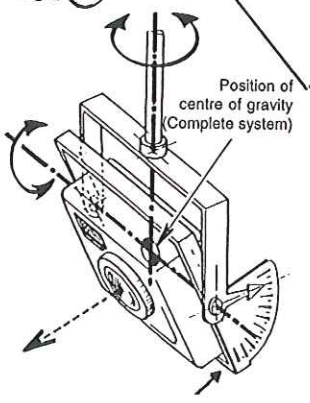
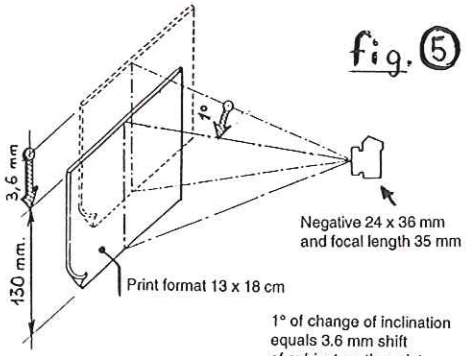


fig. 5



1° of change of inclination equals 3.6 mm shift of subject on the print

II - Ease of setting

In order to quickly and efficiently monitor the inclination of the system, the cradle with a protractor is the simplest and most direct solution.

Also, for maximum sharpness and reliability, it is strongly advised to ensure that the whole system, camera included, is statically balanced. In other words, when designing the cradle, it is important that with camera (and remote controls) mounted, each pivotal axis is at the centre of gravity of the whole rig when suspended. This means that ideally, whichever position you choose for the camera, it should remain there, even with screws untightened. (see figure (4)) And that the pendulum rod should remain perfectely vertical.

Finally, a note about the error margin of this setting:

- it is important to know, for example, that with a "FF9" (focal 35mm) for 1° of error... the subject, on a "23x18 cm" print, will be moved by 3.6mm (see fig (5))

- so for 5° ... 5 times more = 1.8cm! and for 10°... etc...etc...

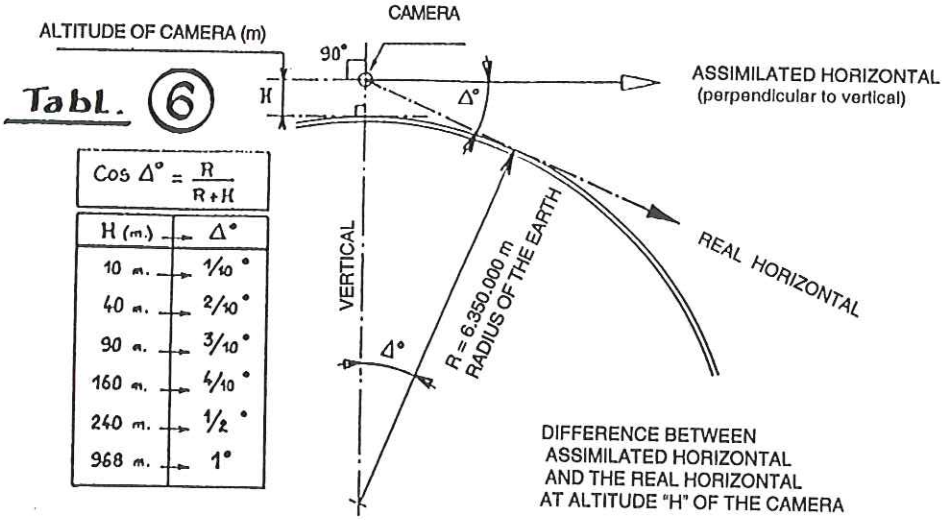
There you are, draw your own conclusions. It is of course a question of being systematic, but also a question of luck, with weather complications.

III - The level of the horizon, seen from the sky.

If on the ground, the horizon, by definition is perpendicular to the vertical. According to the figures calculated here (see table (6)) the reasoning is almost identical, even at an altitude of more than 300m.

Conclusion: even taking into account the insignificance of the possible difference (1/2 degree for an altitude of 250m !); remembering also the

relative instability of the photographic method used, it is simpler to say, once and for all, that in kite aerial photography, the level of the horizon



Tabl. 6

$\cos \Delta^\circ = \frac{R}{R+H}$

H (m.)	Δ°
10 m.	1/10 °
40 m.	2/10 °
90 m.	3/10 °
160 m.	4/10 °
240 m.	1/2 °
968 m.	1°

always remains constant, whatever the altitude of the kite, that is to say, constantly perpendicular to the vertical. So for the horizon in the middle of the picture, whatever the altitude: ZERO inclination, 0°!

NOTE : At more than 1000 metres altitude the above information would be slightly different ... but then, with or without a sponsor, good luck with your kite photos !

ULTRA WIDE ANGLE, STEREO, PANORAMIC, PANOPTIC AND VIDEO.

Wide angle - The use of lenses which cover a wide angle of vision is useful for our activities. As you know, apart from zoom and dual focus compacts, SLR cameras have interchangeable lenses which allow you to use wide angle, ultra wide angle and even fish eye lenses producing angles of up to 180° in width and height. Some even produce circular pictures; these do however present strong deformations which, depending on the case, can vary from very pleasant to very strange.

Stereo- Another technique to explore is stereoscopic photography, also called 3-D or relief. Already in the last century, the inventor Arthur BATUT took stereo photographs by kite.

There are two possible techniques. First, let us consider the one which involves two identical cameras, placed side by side on a bar of variable length and facing, in parallel, the scene to be photographed. Let us remind ourselves that the basic lens distance for ordinary terrestrial stereoscopic photography is in fact equal to the distance between the two eyes, approximately 65mm. As stereoscopic vision is simulated over photographic distances equal to 30 to 1000 times the base, we can see that the range would be rather limited, in this case 1.80m and 60m.

It will therefore be necessary to increase the distance between the two cameras in order to deepen the zone in which eyes and brain will percieve the relief. Distances of 30 to 90cm are good to experiment with, giving an impression of relief up to a distance of 300 to 900 metres. Beyond that, the perception of relief disappears.

For wider bases, the difficulty consists in constructing a rig and cradle

Le TOUQUET - Fisheye lens - aerial photograph by kite
by Yves RAMEAUX - (France) ©

Village of HAN sur LESSE (Belgium) - Lens 17 mm -
Aerial photograph by kite by Michel DUSARIEZ ©

Aerial photographs taken from a kite

rigid and light enough to keep an identical and parallel centring (be careful of effects of twisting). Cameras which have an electric shutter release socket are easier to trigger simultaneously.

The second technique is that of successive shots; we discovered it by chance a few years ago, looking at pictures which looked the same and which we had taken one after the other, strictly in the direction of the wind.

It turned out that a slight movement of the kite had also caused the camera to drift before the second shot which was thus... stereoscopic. This discovery made us realise that all that is necessary to obtain the stereoscopic effect that we are seeking, is a change in position on the ground corresponding to the desired distance between the two shots.

You must, however, take into account that the kite and of course the camera, move with a certain delay. You must also accept that with this technique of shift in position, people or vehicles which have moved in the time between the taking of the two photographs will disturb the perception of relief at that spot. This will not show up too much if the photo is taken at a high altitude.

Practice has taught us that it is a good idea to take a series of photographs rather than just two, so that you can later choose the best pair. If you shoot a series of four, you have the choice between 6 possibilities, pictures 1 and 2, 1+3, 1+4, 2+3, 2+4, 3+4. To look at the stereoscopic pairs the easiest way is the American over/under VIEW MAGIC, (see end of book for their address). Even the most ordinary pictures will thus transcend and take on, because of the magic of relief, a fascinating interest.

Panoramic - Panoramic photography is a completely different technique. There are several possibilities for the amateur. First of all the series of photographs during which the camera turns on itself, either

automatically or activated from the ground by radio control, and takes a series of pictures which overlap slightly. For the taking of series of pictures, do switch off the automatic mode of your camera, if at all possible, this will yield negatives of uniform density which are easier to print correctly.

Careful work with scissors and glue will restitute a 360° scan of the horizon. You must, however, remember that if your camera is not perfectly horizontal, with horizon in the middle and half earth, half sky, the result of the collage will be a an arched picture.

You can also position two or several cameras each pointing to a point on the horizon so that the covered areas overlap slightly. You should ask the photo lab which develop and print for you to switch off the "auto exposure" and block the system on an average level. If not, you may risk that your pictures show differences in colour density which would yield unsatisfactory final results.

Using panoramic and panoptic cameras is also a fascinating adventure. Panoramic cameras are fixed cameras in which the lens turns on its own axis to cover a range of up to 150°. Panoptic cameras are cameras in which the film turns in perfect synchronisation with the rotation of the camera on itself, covering a range of 360° or more. A world's first, to our knowledge, an aerial 360° panoptic by kite was taken by us in Le Touquet (France) in April 1992.

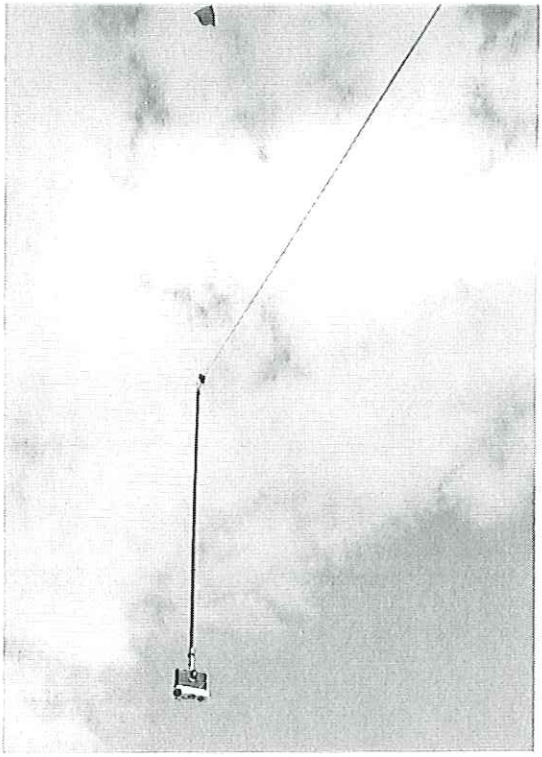
Polaroid - Using cameras which give instant photos is also very pleasant. It can be used in the field to demonstrate the possibilities of the method. However you will only have one copy of each photograph. They are also fairly small and their quality does not stand up to that of conventional color prints.

Video - The use of video aiming has been developed by many users whether it is to simply take a "cinema" shot by sending a video camera

Aerial photographs taken from a kite

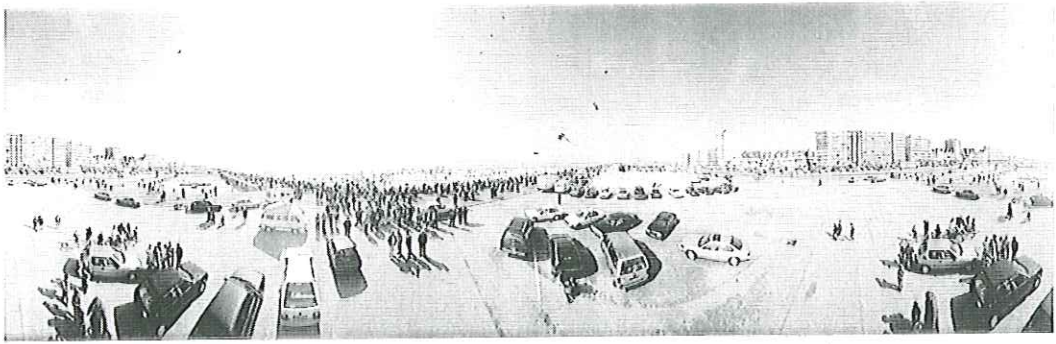
Pair of stereographic aerial photographs taken by kite in two successive shots at Berck-Plage in 1989, during the 3rd Meeting organised by the KAPWA -The photographs are to be viewed with the Under/Over system - see address on page 92. © Michel DUSARIEZ

Aerial photographs taken from a kite



Le TOUQUET
(France)
April 1992

PANOPTIC
aerophotograph
on more as 360°,
taken by kite by
Michel DUSARIEZ ©



aloft, with or without simultaneous visualisation of the recorded images on the ground or to help aiming a normal camera. In fact, the miniaturisation of video cameras and transmitters make all these fascinating options possible, and at a reasonable cost. You should consult catalogues from electronics suppliers. Most offer good video modules at reasonable prices.

However, the fact of being able to visualise on the ground on a screen the centring of the area to be photographed, does remove some of the initial magic and the whole aspect of "discovery" from the experience. Of course, if mystery disappears, efficiency is necessary. Each person must judge for himself.

"CHECK-LIST"

Frank LOUWERS - Belgium

If, after reading this book, you have become attracted to this activity, it is time to roll up your sleeves and get started. Many before you have succeeded by following the advice here, you just have to be very attentive and careful, the rest is easy.

- Set yourself a time limit, so as to put yourself under pressure.
- Do not be discouraged by bad luck, but persevere.
- Get to know your kites well; check them regularly, preferably before each flight.
- There is no one single solution. Pick and choose between systems that attract you and make your own personal choice. Do not be afraid to opt for simple solutions in the beginning.
- Always have a well-stocked "first-aid kit" with you with the basic tools: ripstop repair tape, batteries etc and some lengths of spars identical to those of the kites you use.
- Block the focus of your camera on infinity with sticky tape, select shutter time, aperture and film speed in accordance with the available light.
- Seal the view finder of reflex cameras to prevent any light from getting in and disturb the metering system to cause exposure errors.
- Make notes of the different flight and photographic parameters, this will help you improve.
- Remove the lens cap from the camera before flight.
- Finally, prepare a CHECK LIST to avoid forgetting anything.

WARNING

If it is calm and peaceful around the area where the kite photographer is working, this is ideal and he will be able to devote his attention to his work. Nothing is more dangerous close by than other kite fliers with their kites and lines threatening to cross ours and cut it any minute.

As big kiting events nowadays cater almost exclusively for stunt kite competitions, the stars of this "sport" tend to lay down the law. Take care not to obstruct them with your mere presence; all available space belongs to them in priority.

You will understand why we do not advise our readers to go and practise their aerial photography at these gatherings.The probability of accidents and the gravity of the risks are beyond comment. Also, the other kite fliers present will probably not be very interested in our activities or in the results obtained.

As proof of this it is enough to look at the organisation of most big kite events nowadays. The same clique of organisers, commercial people and competitors are always there, full of their prerogatives. Strange to think that ambition and venality can often be found alongside enthusiasm and a sense of sport among the participants.

Events at which certain participants try to make believe that they are "pros" while at the opposite end, the real salesman hypocritically takes on a label of amateur or artist: there is however unanimity about one thing, everyone is determined, behind a benevolent exterior, to fight fiercely for his share of the cake.

After several years of this deplorable situation, it can be noticed that the most valid elements have left association kiting to practise their art

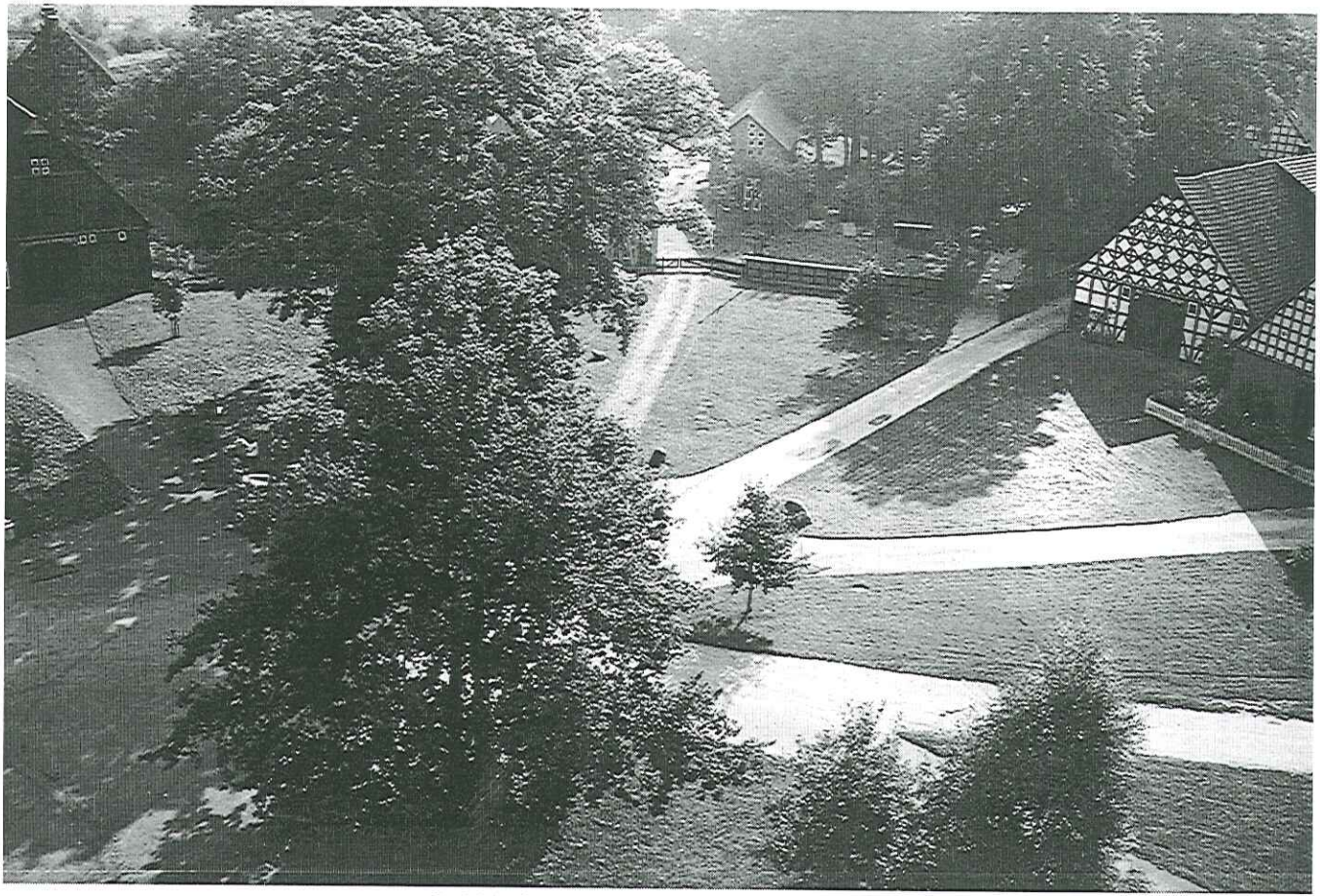
alone, in peace, far from this sordid wrangling.

Having been among some of the first victims of the disaster, we thought it would be useful to mention the causes briefly here. If several notorious opportunists are now pulling the strings of association kiting, our group categorically refuses to be held to ransom or be dictated by anybody.

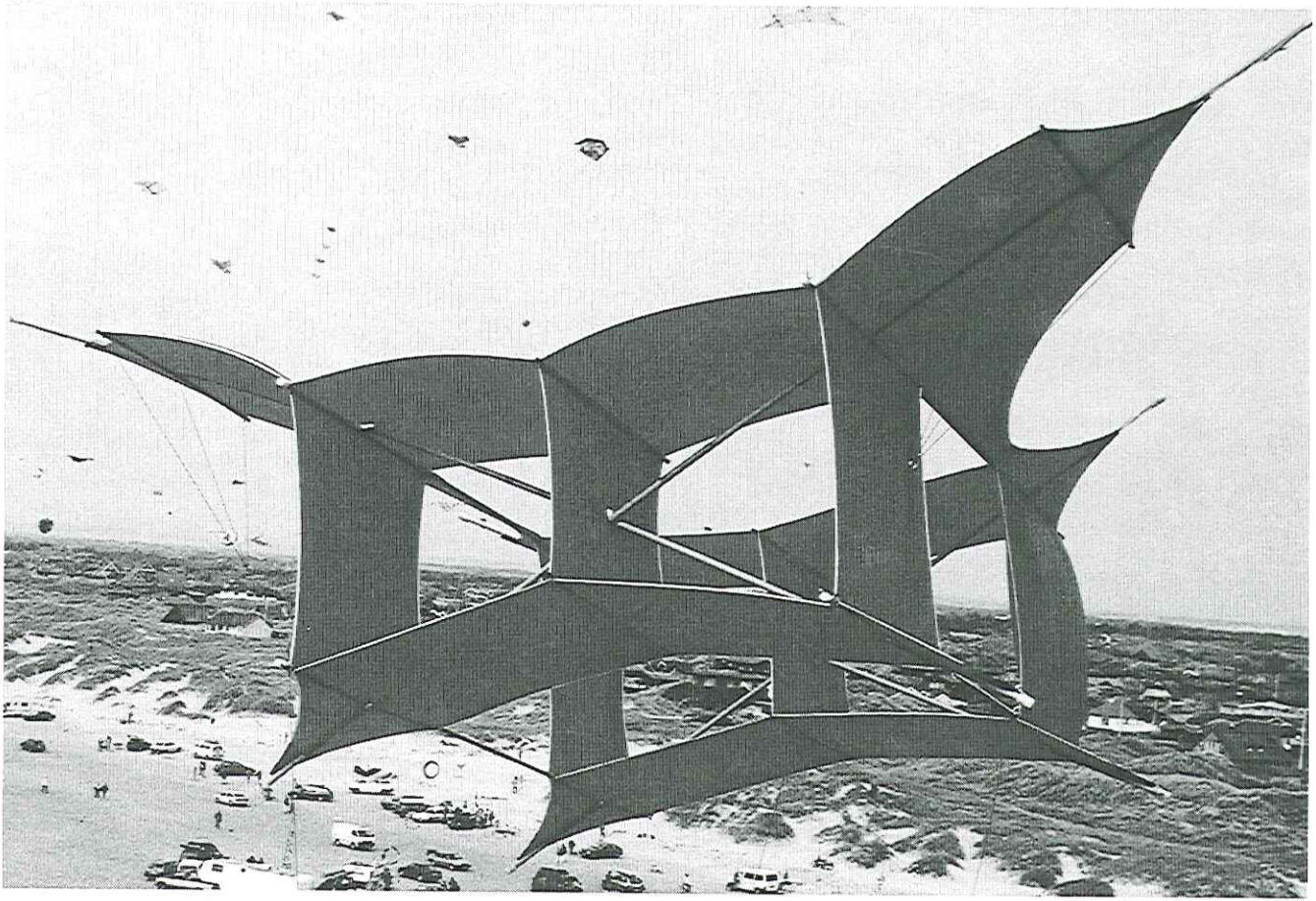
For newcomers to kite aerial photography, we would suggest that you remain vigilant if you are thinking of joining a local or national kiting group. Do take your time beforehand to observe the preferential activities of the other members you will meet in the field. You will quickly understand how much - or how little, your aerial photographic contribution is valued by the association.

Kite in flight at Long Beach - WA - (USA)
Aerial Photograph by kite by Michel DUSARIEZ ©

Smögen - Sweden - 1993 - Aerial photograph by kite taken by Wolfgang BIECK - Germany©



Stubble-field near Bad Bevensen - Germany - 1991
Aerial photograph by kite taken by Wolfgang BIECK - Germany©



Cody kite over Fanø - beach - Denmark- 1995 -
Aerial photograph by kite taken by Wolfgang BIECK - Germany©

AND NOW ?

At the moment when he is about to close this book and go to his workshop to carry out his plans, we would like to welcome the new aerial photographer. He will soon belong to this inevitably small community of those who have managed to transform their view of their environment. Which one among us could have forgotten the almost incredible joy and surprise which we very probably felt when we managed to take our first photo by kite ?

In our opinion, such an extraordinary extension of our vision, obtained with very simple means while we remain planted on firm ground seems almost miraculous and must produce enthusiasm.

But there you are, our present times, so full of haste and harassment hardly lend themselves to any prolonged wonders. One gets used to everything, even to miracles.

However we are still and always a bit surprised when an kite photographer, after showing us the album of photos taken throughout the year, says: "Now - what else can I come up with, now that aerial photography no longer holds any secrets for me ?"

... As if the fact of being able to correctly expose a few rolls of film had covered all the beauty spots of the Planet and exhausted all the possibilities of the method...

We belong to that group of veterans who remember the very primitive mechanical shutter releases, at the time when the camera, fixed in its one direction under the line, really remained "black box" until it revealed the image brought down from the sky; so more than anyone, we realise how much successive progress brought to our activity, has taken away the enigmatic aspect and the uncertainty which previously brought some spice to the charm of the adventure. But what does it matter? Isn't it the

same for all technical progress?

Kite aerial photography had nothing else to lose since in our opinion it was much more than a hobby... another way of looking at the world.

When we came accross it first, around 1958, at the end of the long night into which the war had forced it, radio control devices were not yet available on the market, so we had to go ahead step by step, like at the age of the pioneers. We also had to resign ourselves to many failures, especially due to our inexperience.Should we have given up under the pretext that our efforts had no goal, when our patience had no limits?

At any rate, our personal adventure taught us that photographic kiting is a universe to itself which can always be perfected and of which we never master all the elements.

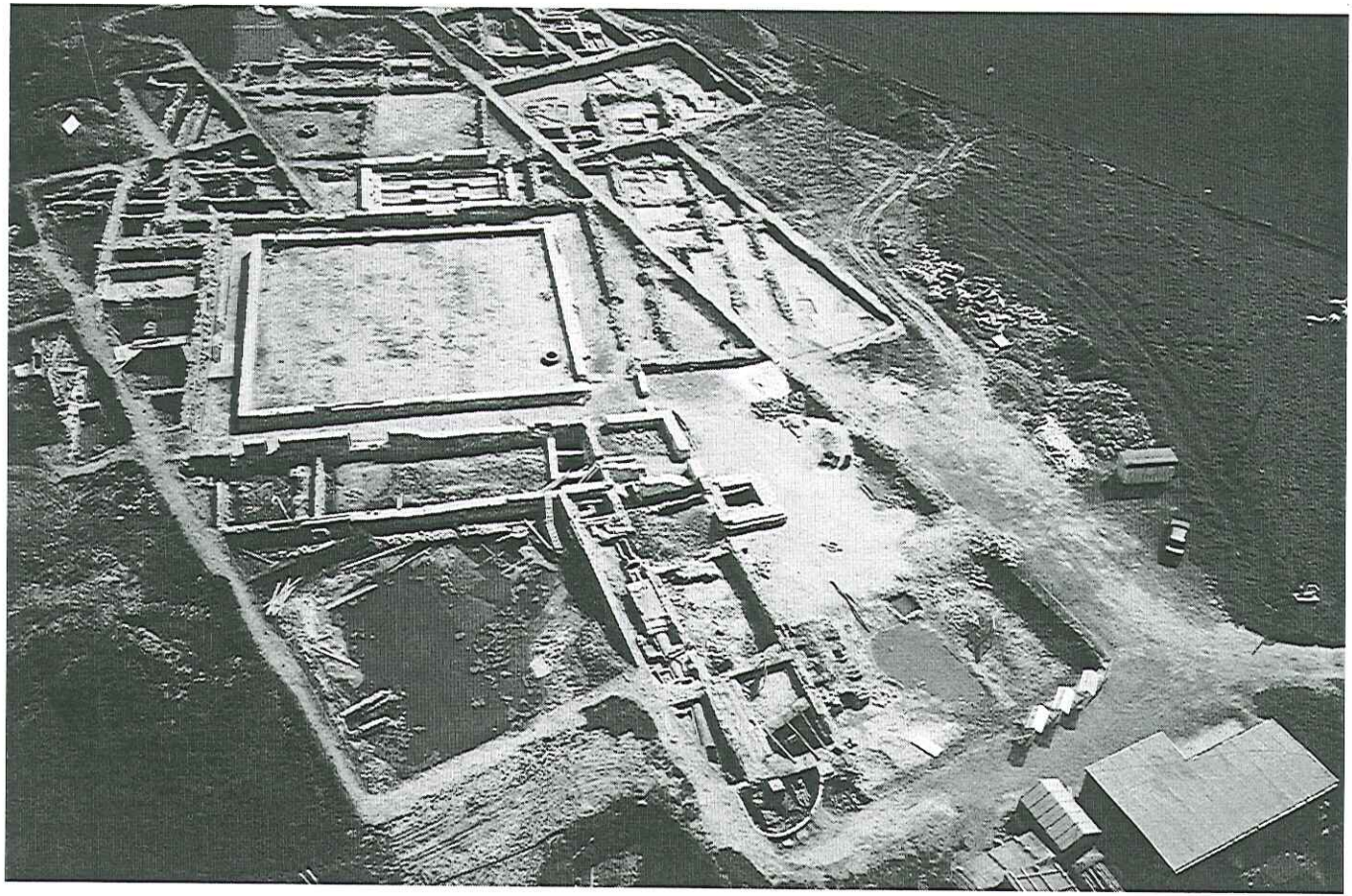
And still nowadays, this occupation seems forever more fascinating as it constantly makes us go beyond our own limits because, however reliable and up-to-date the equipment, nothing can ever be taken for granted.

The range of subjects to photograph from the sky is so vast and diversified that it defies any sort of inventory, however succinct.

Towns and villages, castles, farms and mills unfold under the vibrant wings of our kites.

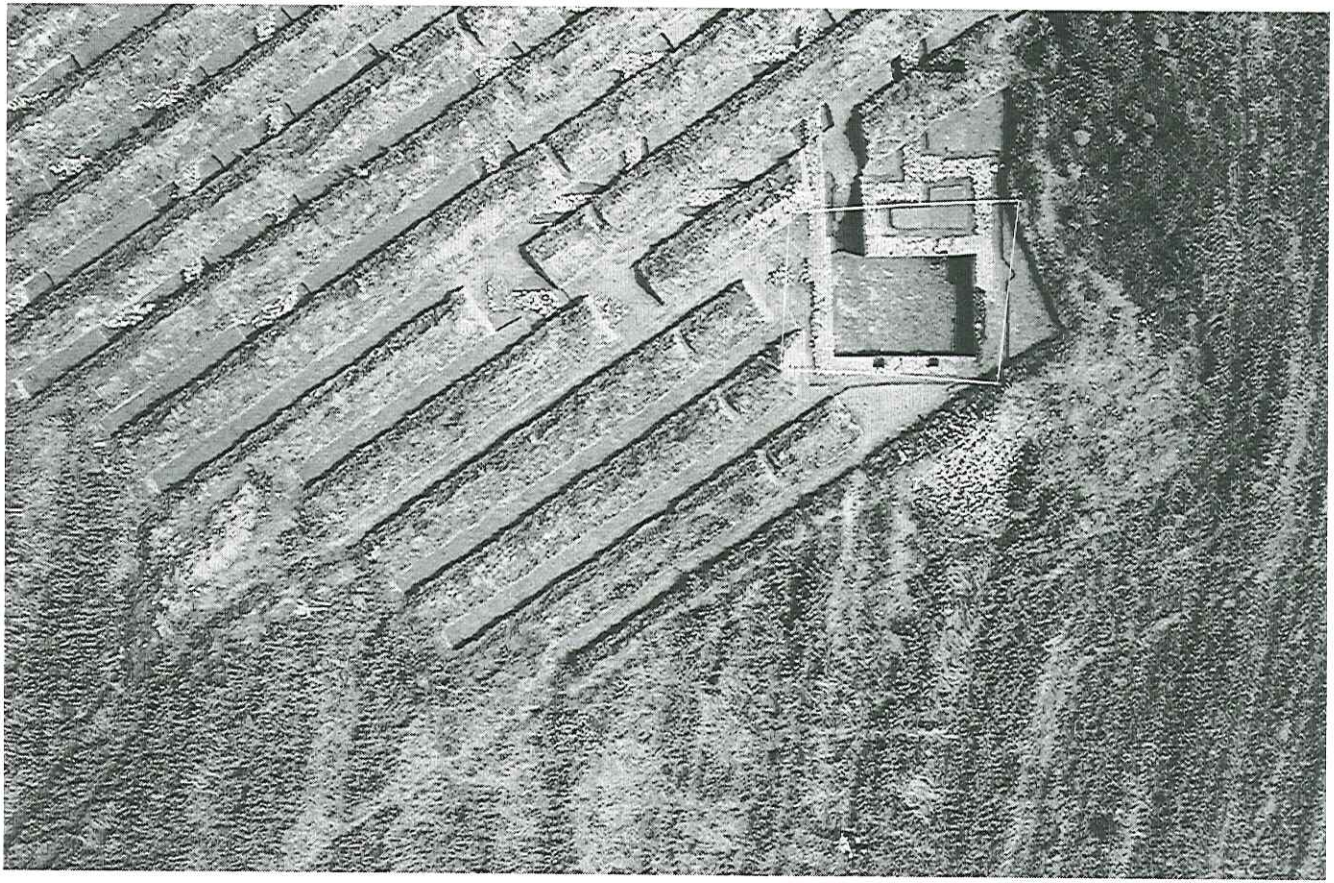
For blasé amateurs, bored with the monotony of too often repeated lanscapes in their region, there is the alternative of architectural or industrial views, or again certain sites the position and configuration of which suggest past or surviving activities of countless generations.

That is history which can be read on the ground.



Mediaeval port and village of ENAME (OTTO II 974) - Oudenaarde - (Belgium)
Aerial photograph by kite by E.REGOUT ©

Aerial photographs taken from a kite



Gallo-Roman vestiges at La Tournette - Nivelles (Belgium) - Overall view
Aerial photograph by kite by E. REGOUT ©

Aerial photographs taken from a kite

Scientists have found kite aerial photographers to be useful helpers; this is the case in a wide area of research, particularly related to agriculture and nature preservation.

Briefly, what we want to say is that, as much on the human as on the practical level, our activity provides an inexhaustible source of observation and thus of learning.

No artificial process will ever reveal the complete truth about a person or a landscape.

The aerial photograph of any given site will merely give us a new angle of observation, a new insight, a new restitution of existing values.

The play of light and shadow throughout the hours of the day will bring a never ending change to these pictures.

But the variety of geographical and meteorological conditions with which we find ourselves confronted is just as infinite. The experience of the kite aerial photographer will depend on his ability to react efficiently to the forever changing conditions he has to adjust to immediately.

The experienced aerial photographer will take the unalterable lesson of life to heart that since one cannot control events, it is better to go along with them.

Archeological diggings at AL-TUR - (Egypt)
Aerial photograph by kite by Katsutaka MUROOKA - Tokyo - Japan ©

SOME GOOD ADDRESSES

KAPWA - FOUNDATION
14, avenue Capitaine PIRET
B-1150 BRUSSELS-BELGIUM
Fax 32 2 512 68 29

Club associated to the KAPWA-FOUNDATION, publications in Japanese, very interesting illustrations.

- JAPAN KITE AERIAL PHOTOGRAPHY ASSOCIATION -
Président : Katsutaka MUROOKA (write in English)
2-42-7 SHIRASAGI- NAKANO-KU - TOKYO 165 - JAPAN

Magazines published in English :

- KITE LINES - Published since 1977
P.O.Box 466, Randallstown, MD 21133, USA.

- AMERICAN KITE - Published since 1987.
P.O.Box 699, Cedar Ridge, CA 95924, USA.

- DRACHEN Magazine International (first year)
59 Makara Road, KARORI, WELLIGTON - NEW ZEALAND.

Photo magazine, history and general interest.

- CYCLOPE, B.P. N°1, F-30140 MIALET, FRANCE.

Various associations (publications in English).

- INTERNATIONAL STEREOSCOPIC UNION
ISU - P.O. Box 19-119, HAMILTON, NEW ZEALAND.

- INTERNATIONAL ASSOCIATION
of PANORAMIC PHOTOGRAPHERS.
IAPP - P.O.Box 2816 - BOCA RATON, FL 33427-2816
USA; Tel : 407 451-4622 - Fax 407 361 - 0494

Material for stereoscopic vision.
VIEW MAGIC visioner
- DIMENSION PRESS,
PO Box 83, HARVARD, MA 01451- 0083, USA.

Book about 360° panoptic photography
360° PANOPTIC PHOTOGRAPHY EXPERIMENTS -
M.DUSARIEZ, L. PIERROUX, L.R.LARSEN- ISBN 2-96000-48-1-7.
146 pages format 10X29cm - English version available via the KAPWA-FOUNDATION - 800 BEF p +p - airmail included everywhere.
Outside Belgium : payment only by credit card.

Arthur BATUT Museum.
MUSEE Arthur BATUT - 9 Ter, Boulevard Gambetta,
F-81290-LABRUGUIERE- Tarn, FRANCE.
Informations and visit : Phone 63502218

Disaffected railway bridge at DOMITZ (Germany)
Aerial Photograph by kite by Michel DUSARIEZ ©

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33 numbers appeared, from September 1985 to December 1993.

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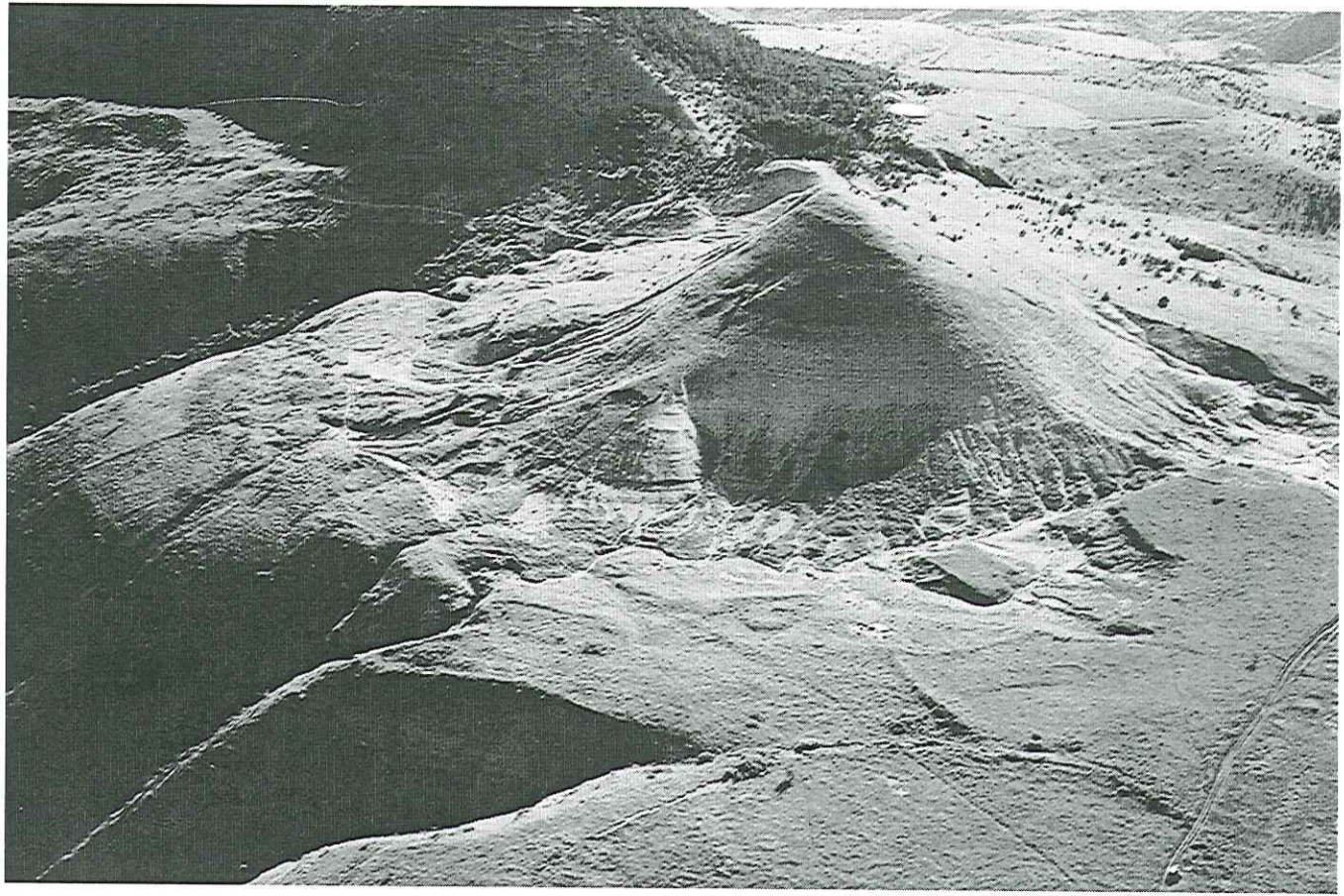
Without claiming to be exhaustive, this bibliography brings together works specifically dealing with kite aerial photography and will provide the reader with a fairly substantial base. We did not consider it appropriate to list hundreds of books on kites nor to mention innumerable articles published in periodicals.



Mound - Le Puech des Bondons - Mont Lozère - Florac (France)
Aerial photograph by kite by E. REGOUT ©

On the following pages we have printed a translation of the book by Arthur BATUT

AERIAL PHOTOGRAPHY BY KITE

This study, already more than 100 years old, from the hand of the inventor of kite aerial photography was the very first work ever published on the subject. It is almost impossible to find nowadays. We decided to reproduce it here for its historical interest.

Translator's note: Rather than trying to render The Inventor's late 19th century French in a similar style of English which I would not have managed, anyway, I have tried to produce a more readable version.

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LA

PHOTOGRAPHIE AÉRIENNE

PAR CERF-VOLANT

PAR

ARTHUR BATUT.

PARIS,
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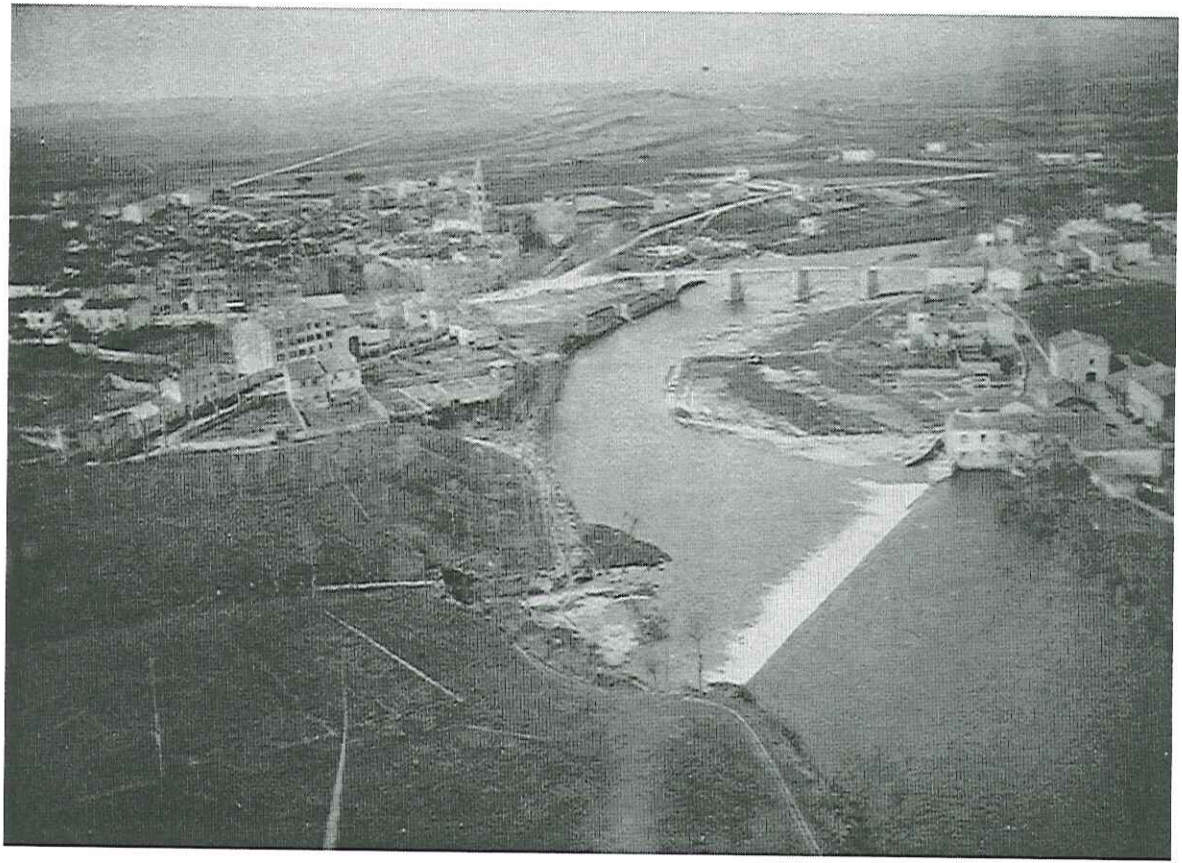
Quai des Grands-Augustins, 55.

1890



Perspective view of LABRUGUIERE, (Tarn - France)
photographed by kite from 90 meters altitude at 11 AM on the 29th of March 1889.

AERIAL PHOTOGRAPHY BY KITE
by Arthur BATUT

INTRODUCTION

When in the spring of 1888 we read the fine work of Mr. Gaston TISSANDIER "Photographie en Ballon",(1) we were surprised that nobody had come upon the idea to use a kite instead of a balloon. If on one hand, aerial photography will doubtlessly find countless applications of undeniable usefulness, it must, however be admitted that the carrier of the camera, the balloon is a cumbersome affair, expensive as it is and depending on a considerable equipment for transport and especially for inflating. Moreover, it takes several people to handle a balloon. Today, it has been demonstrated that it is possible to take perfect photographs from a balloon, and we can already foresee a long list of possible applications. But in order to bear fruit - to really be useful, a discovery must be within the reach of everyone. However, photography by balloon is reserved for the few, who priviledged by fortune can indulge in scientific research. Fifteen years ago, ordinary photography

(1) TISSANDIER (Gaston), La photographie en ballon, with a phototype print of a negative obtained from 600m above the île Saint-Louis, Paris, In-8, with illustrations 1886 (Paris, Gauthier-Villars et fils).

was the preserve of a few adepts, whereas today, it is shared by everyone, a photographic pencil, so to speak, which may be taken along by the explorer, the tourist or the man who is simply out for a walk. Which magician mastered such a change in so short a time? The silver-bromide gelatin which, by reducing manipulation to almost nil, simplified and lightened photographic paraphernalia The aim of this work is to disseminate aerial photography by making it easy and by putting it at everybody's disposal so that it can be put to all its possible uses.

As we are convinced that in such matters, experience is the only infallible guide, we have made it our strict rule to describe only equipment built and tested by ourselves, only techniques yielding good results. Disregarding this for just one instant is the certain way to error.

1

ADVANTAGES OF THE KITE COMPARED TO THE BALLOON

As we said in the opening, the only obstacle to the expansion of aerial photography lies in the balloon itself. Cumbersome and expensive, this apparatus still requires a relatively long preparation before being able to take to the air, a reason for lack of success in operations due to poor light conditions, if ascension is delayed for too long. To substantiate this, we quote the account of the experiment made by MM. LAIR and GUILLON on the 15th February 1884 and reported by Mr. TISSANDIER (1): « As the balloon could not be inflated rapidly enough, it was four o'clock before the operators could to begin the experiment.»

The use of the kite, always at hand and ready to take off and lift the camera, offers a way for operators to avoid one cause of failure. But, some will say, wind is necessary for the kite, and in dead calm, any operation becomes impossible.

Our answer is that with the balloon, it is the other way round, at least when tethered, which is most often the case. It must be granted then, that at least the kite could be considered a substitute for the tethered balloon, when wind does not permit the latter to go aloft. We believe that we may claim that, even in calm weather, it is possible to fly a kite, not at a high

(1) TISSANDIER (Gaston) La photographie en ballon, p. 26.

altitude, but high enough anyway to get a bird's eye view. We shall come back to that subject later.

II

DESCRIPTION OF THE EQUIPMENT

Before entering into a description of work in the field, we believe it useful to go into all the details of the construction of: 1° the kite; 2° the camera; 3° the means by which it is suspended; 4° the shutter; 5° and finally, choice of lens and photographic process.

The Kite. - For most of us, the kite is an old friend, one of those toys where the constructor's skills are all-decisive and which from our most distant memories recall images of a father or a friend. Unfortunately, few scientists after Franklin have used it and usually, empiricism prevails in its construction. We were lucky enough to find some articles about kites in the magazine «la Nature», and in particular in the 26th February 1887 issue, we found the detailed description of a kite by Mr. Esterlin, professor at the Bazas College. This model, which we adopted, yields excellent results and with modifications in the detail, we lightened it to a point where the weight of the kite, complete with camera, hardly exceeds the weight of the kite of identical size made by Mr. Esterlin. In practice, this is very important. The altitude which a kite may reach is in fact limited by the weight of the line it is capable to lift. The more we reduce its own weight, the more line may be paid out and the higher it will fly. But back to the construction itself. Mr. Esterlin's kite is made of conventional reed the length of which, divided by 10, will give us the

standard unit measure to guide us in the construction. As an example, let us take a reed of 2 m; one 10th of its length is 0,20 m. At two units from the thicker end of the reed, in other words at 0,40 m, we attach the bow made of two osier sticks, each one, five and a half units or 1,10 m long, which, when put together should form a seven units length or 1,40 m, the two thickest ends of the sticks tied together. This done, we fasten the periphery string in notches made at both ends of the reed as well as in those made in the bow and tighten it in such a way that we give the bow a camber of approximately one unit or 0,20 m. We then cover the kite with light, but strong paper, reinforcing it with thin cloth at each of the four corners and at the two bridle points. These points are located, one where the bow crosses the backbone, the other at three units from the thinner end of the reed or at 0,60 m. The bridle must be so long that, when stretched to one side of the kite, it slightly exceeds the tip of the bow. At the height of the tip, a loop is made in the bridle, a loop through which we attach the tether line by means of a wooden toogle. A strong length of string connecting both ends of the bow above the back of the kite, can be tightened according to wind force, to give the kite a more or less convex surface for greater stability.

Although the equipment thus described in *«la Nature»* is presented as a tailless kite, we must admit that we never managed to fly it without this unhandy and fragile appendage which, so far, we have found essential.

In the following, we describe the modifications we introduced to the kite described above. We replaced the reed which is often heavy in the dimensions mentioned above (0,08 m to 0,09 m in circumference at the thick end) by two lengths AB of 0.020 m x 0.005 m light, strong wood (Carolina poplar) with very straight grain.(fig. 1). At the fourth unit from the top end, these two lists, strongly tied together at both ends, will recieve a light box of the same thickness as the width of the lists and having the shape of a trapeze A'B'C'D', the narrowest end facing the tail. This box which is two units long, has all sides nailed and glued. Two strong string bindings and some nails will keep it in place between the

two lists. The camera bracket will be attached to this box.

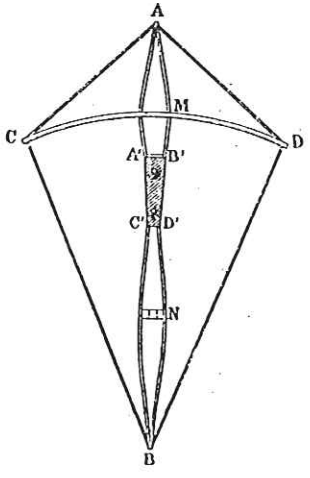


fig 1

At both bridle points, light but strong wooden braces, M et N, put the two lists under tension by spreading them, thus ensuring maximum rigidity. These two braces will suffer strong traction and violent jolts, so all possible care must be taken to ensure their careful fastening. A few light nails and most of all, methodical binding using quality string gave us the best results. To prevent the bridle from slipping sideways, which would result in a lopsided flight, wrap a glued string around the whole length of the braces, leaving an empty space in the middle, to which the bridle will be attached. For kites longer than 1,50 m, to make the bow C D, rather than osier, we prefer to use two fencing foils welded together at the hilt. The button ends may either be wrapped with glued string to which we leave a loop, or may be replaced by ringlets forged by bending

the tip of the foils. It is through these loops or rings that the periphery string will pass. In such lengths, foils offer both flexibility and total strength. Their connection to the two lists is made on the brace closest to the nose by tying them with glued string. To protect the string against the sharp edges of the foils, it is advisable to cover the latter with thin cork or softwood boards where they are joined.

This special layout of the kite's frame offers, apart from its extreme lightness and resistance to torsion, a clear advantage for our purposes for the camera suspension. In fact, a sudden gust of wind is likely to cause the reed to twist where it is tied to the bow and, the camera being connected to the reed, the lens will lose its direction (1). With the new lay-out of the frame, this accident is no longer to be feared, as both surfaces in contact with lists and bow are plane.

Since we could not get rid of our kite's tail, let us resign ourselves to describing it. This appendage, which by the way is quite graceful when it floats in the air, is designed to give the kite a relative stability which it would totally lack without it. For a kite the tail plays the same role as for the lizard: it governs movement. It should be at least four times the length of the kite and made of a double string on which common knots are tied to hold rectangular pieces of paper. These rectangles must be one and a half units long and half of that wide. (Thus, in the case of a 2 m kite, it would be 0,30 m by 0,15 m); they are twisted in their centre and a knot is tied around each one. They should be spaced approximately by one unit or, 0,20 m. A wooden toggle at one end of the tail is used to attach it to the lower part of the kite where a string with a loop is strongly attached. In general, one makes do with a single string, but wind may cause the tail to twist to such a degree that it untwists itself and breaks.

(1) If circumstances force us to use a reed, one way to avoid this problem is, after having dulled the reed with a rough file to glue it with a strong glue to a piece of cork into which a grove has been cut to harbour the reed. This piece of cork is then carefully ground plane on the opposite side and it is on that side that the bow will be fixed by a crossed string binding containing reed, cork and bow.

This sort of accident causes the fall of the kite which takes a nose dive as it is called and thus runs a serious risk of being wrecked. The double string avoids this risk.

The Camera. - It is easy to foresee that cameras found in the trade, well made as they might be, have neither the strength nor the lightness suitable for the new use to which we are to put them. Therefore, we thought up a model which we tried to simplify as much as possible. The three conditions we attempted to meet are: 1° extreme lightness, 2° solidity (to withstand possible accidents at launch and descent); 3° - absolute constant distance between lensboard and negative surface, even under violent jolts. This latter demand forces us to avoid the bellows and to build a camera with fixed focus, the only design which we find rigid enough. Thus, our camera will be a box made of 0,004 m thick softwood which will simply be assembled with nails and glue. Inside, the wood will be painted black using iron pyrolignite and outside the box will be covered with black paper called needle paper, glued with starch paste. This will increase the general strength and prevent light leaking in through wood or joints.

Of course our box will be open on one of its sides; the lid which we will adapt to it will be made of a 0,01 m thick wooden board.

In this board a groove will be cut along the sides into which the four sides of the box will fit. Two small nails stuck through holes drilled through the sides of the box and the board will act as dowels and secure the lid sufficiently. To prevent the nails from falling out and to prevent light from from entering the box, we seal the lid with two superposed rubber bands.

In the side opposite to the opening, we cut a hole for the lens. Since the lens must be a symmetrical lens, it will not be a problem to invert it and thus to fix it inside the box to reduce the chances of accidents.

The plate holder will simply be a piece of hickory board 0,002 m thick; and of such dimensions that it will just fit into the box.

It will be kept rigid by two small strips of wood glued to its back, perpendicularly to the wood's grain. It is on the other surface that we will place the sensitive material, paper or film by using a gummed paper applied along all four edges (1). Four small nails will be driven in near the corners of the box and, by protruding inside of it, will serve as stoppers and support the board which will be held rigidly fixed during operation by four drawing-pins pushed into the sides immediately behind it.

Since we do not accompany our camera aloft, we cannot focus for each take as it is done when taking photos on firm ground. However, in our particular case this is not so important as there is no foreground and as we always work at quite considerable distances. Whether we photograph vertically or at an angle, the nearest objects will be at a distance of 80 m to 100 m from the lens. Under such circumstances, it is easy to establish a standard focusing for that distance and we will be certain that objects farther away will also be sharp on the negative. For this operation, we place our camera, lens inside on a tripod, 75 m away from from a large object offering details and having sharp outlines: a wall with a sign, a monument built from large grainy stones, a row of trees having their rough bark lit-up by sharp sidelight.

Inside the camera, a ground glass fixed on a board at a right angle, will be moved back and forth and when we arrive at the point where the image is perfectly sharp, we draw a line on all four walls of the camera, exactly

(1) To avoid buckling of the film, after laying it face up on the board, we cover it with a glass plate covered with black paper. We press the glass on to the board with spring clips and then apply the adhesive paper. It goes without saying that the film should be somewhat smaller than the board and that the glass should be slightly smaller than the film. Once the adhesive paper is dry (which only takes a few minutes), the glass is removed.

where the surface of the ground glass comes in contact with them (1). It is on that line and near the corners that we will drive in the small headless nails called glaziers nails which will support the plate holder described above. To finish the camera, we only need to place a copper bolt through each of the larger walls, head inside and nut outside. This will allow us to fix it to the bracket described later on. To prevent unwanted reflections, the bolts' heads will be covered with black cloth.

Means of Suspending the Camera. - For our purposes, we cannot hang the camera in gimbals which apparently yield good results with balloons. The often abrupt motions of the kite would cause endless movement. On the contrary, we must make our camera an integral part of the kite so that the two may be considered as one single unit. After much trial and error we turned to the simplest way and settled for a bolt connecting the camera to the bracket, the obligatory intermediate between camera and kite. Our bracket is a triangular box fixed to the woodwork of the kite by means of two strong bolts, and which allows a hand to enter to tighten the nut of the camera's bolt passing through one of its sides. Now, there may be two possibilities: do we want to photograph vertically or at an angle?

In the first case, the axis of our lens must be parallel to a plumb-line, in the second case, it will be necessary to give it a certain angle to the horizon. Let us consider the first case, where we want to photograph vertically.

(1) For those of our readers who do not have a ground glass of the necessary dimensions at hand, we would like to mention a very simple procedure which could take its place. After having an ordinary but truly plane piece of glass cut to the size of the camera, it is carefully passed over the flame of an alcohol lamp. When it becomes too hot to hold, it is rubbed with a roundel of pure wax which immediately covers it whith a transparent layer The glass plate is left to cool while turned in all directions to evenly distribute the wax. Once completely cooled, this layer loses its transparency and looks like the finest ground glass.

The first thing to consider is the angle of the backbone of the kite in relation to the horizon. At a first glance, it would seem difficult to determine this angle exactly, as it constantly decreases, as the kite climbs. Firstly because of the increasing weight of the tether line it is carrying and secondly, because of wind drag on the tether which causes it to describe a more or less pronounced curve. However, it is worth noticing that this angle becomes constant, once the kite has found its balance in the air. Although in practice, mathematical precision is of some importance and although, in a general way, one may admit that the kite's backbone forms an angle of 33° to the horizon, we also know that the slightest variation in the proportions of the bridle may modify this angle, which is why we shall describe a very simple procedure which we conceived to estimate the angle quite precisely. Here photography shall help us and the kite itself will record the angle it forms with the horizon when aloft. The knowledge of this angle will allow us to construct our bracket without trial and error.

How to Establish the Angle Between the Kite's Backbone and the Horizon.- We will take a rigid piece of cardboard which we will cut exactly to fit our camera and which will take the place of the sensitised surface.

We will cover this cardboard with onion-skin paper, three sides of it being folded back and glued. We thus obtain a sort of pocket into which we can slip a sheet of gelatino-bromide paper.

Using a protractor, we draw a quadrant on the onion-skin paper, whose 0° will be on a line parallel to one of the short sides and the 90° on a line parallel to one of the long sides. At the central point of the quadrant, we pierce a hole through which we pass a plumb-line fixed at the back (1). Having removed the lens, we insert the cardboard, onion-skin paper and photographic paper facing the shutter, into the camera and close it. We fasten the camera directly to the kite's backbone by its larger side corresponding to the 90° mark, and in such a way that the 0° mark, and

(1) Our plumb-line is made of a very thin black thread at the end of which we fix a piece of lead like the ones used by anglers for sinkers.

consequently, the fastening of the plumb-line are facing the kite's nose. The axis of the camera is perpendicular to the backbone. The trigger wick (1) being lit, we launch the kite. When it arrives at its normal working altitude (which requires no more than a couple of minutes, if all the line has been paid out from the start), it will assume a fixed position from which it will not deviate much during the experiment. What will happen inside the camera? After some swinging, the plumb-line will stop and face one of the quadrant's marks. When the shutter is triggered, light will enter the camera, and project the quadrant's dividing marks and the plumb line's shadow on the sensitised paper. Back in our darkroom, we only need to develop the gelatino-bromide paper to know the exact angle.

The Camera Bracket. - If we were to suspend our camera by its rear end (which we did to begin with), our bracket box should have, between its upper face (the one fastened to the kite) and its lower face (the one supporting the camera) an angle of 33°.

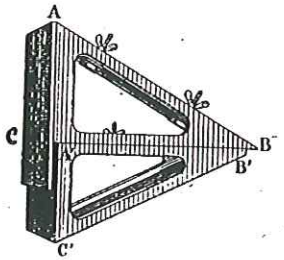


fig 2

Already early experience taught us that it is careless to hang the camera by its removable part; so it will be one of its sides that we attach to the bracket. This however, does not mean that we will have to alter the shape of the bracket. In fact, if built as shown in (fig. 2), it gives a 33° ABC angle and a right ACB angle. Therefore, the CB part will be horizontal

(1) See later paragraph, *The shutter*

and the AC part (1), vertical (both lines being perpendicular to each other), as soon as the kite has taken in the AB line in the air. This being so, if we bolt one of the sides of the camera to the AC part, the lens axis will be vertical and our camera will be in a position to take photographs vertically.

Do we wish to take photographs at an angle? Underneath the bracket described above, we attach a second box similar to the first, but where the A'B'C' angle is no longer 33°, but at a degree that permits us to obtain a photograph at an angle. In practice, an angle of 26° gave us good results. The A'B' part of that box will be fixed to the CB part of the first one. It is to the B'C' part of this second bracket that we attach the large side of the camera, the axis of which will be 26° below a horizontal line. This device is useful, because of the possibility it offers (the CB part of the first bracket always remaining horizontal) to turn the lower bracket around the bolt connecting the two brackets. Thus, maintaining the same angle to the horizon, the operator can point the lens at all points of the horizon not covered by the rear end of the kite and so, cover a considerable angle of view. The reason for installing a bolt on each of the large sides of the camera, is that, when taking vertical photographs, it is the under-side of the camera which must be fastened to the AC board, if we want to avoid the smoke of the release wick to be blown toward the lens by the wind. On the contrary, if we want to photograph at an angle, it is the upper side of the camera which has to be fastened to the B'C' part of the lower bracket in order to avoid the same problem.

To which point of the kite do we attach the bracket? We have already seen that it must be on the trapezoidal shaped box which separates both longerons of the kite between the fourth and fifth unit from the nose. This spot was not chosen arbitratily and it was the search for it that probably caused us the most problems. At first, of course, the most appropriate

(1) We allowed the forward facing side, AC a slight surplus underneath the bracket in order to increase the contact surface between it and the camera when the latter is in the position for taking vertical photographs.

point appeared to be the part of the backbone immediately under the lower bridle point. There, nothing would be in the way of the lens, all lines being above it. But the experiment was less than satisfactory. The kite was hardly a few yards in the air, before it seemed to get a fit of vertigo; it quickly went into a series of somersaults which brought it back to the ground with an abruptness that must have made it suffer. We then placed our bracket at an equal distance between the two bridle points. The results, although not quite as poor, were still very bad; truly, the kite did not spin anymore, but it was swinging quickly which made it impossible to take pictures. It was only after countless experiments where gradually, we moved the bracket forwards that we finally found the favourable point from where it was possible to obtain a photograph, the point where the kite is relatively calm. The best position for the camera is at the fourth unit from the nose of the kite. (1). Consequently, for a vertical view, the camera being attached to the front of the bracket, the latter should be located at the fifth unit and, for a oblique view, the camera being attached below the bracket, this should be located closer to the head, at the fourth unit. This is why the box must be two units long so that it will allow us to move the bracket forwards or backwards, according to the intended aiming. In this position, the camera will in no way impair the kite's stability, but the view we shall obtain will be crossed by the image of the bridle. The procedure we imagined to avoid this problem consists in the modification of the bridle while keeping the same attachment points and the same point of traction. The bridle lines are simply spread aside and form two triangular windows (one vertical for oblique views, the other horizontal for vertical views), allowing the lens to freely cover the field, while not modifying in any way the lines of traction, thus giving the kite a stability comparable to that offered by an ordinary bridle

(1) If, for example, we take a 2 m kite, the camera will have to be fastened to the backbone so that it occupies the portion between 0,60 m and 0,80 m starting from the nose.

The Bridle. - This is what it looks like: two lines are fixed to the upper bridle point 0 (fig. 3). We make them so long that, by passing by the ends of the AB bow, they can reach the lower bridle point X.

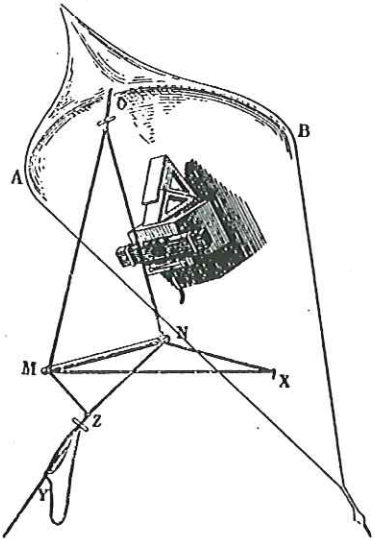


fig 3

We add to this length, what we consider necessary for the knots. This being done, at the OB and OA distance, a knot is tied on each of the two lines. On to both of these lines, we thread a sort of yoke or swingletree made out of reed, MN, equal in length to OA, with a hole at each end. On each of the two strings a knot is tied immediately below the hole, in order to keep the swingletree in position. Then, holding the ends of the swingletree first to A and then to B, the lines which hang underneath are fastened at the lower bridle point.

After both lines have been fastened this way, both ends of the swingletree are joined by a loose line, in the centre of which we make a loop Z (1). It is to this loop that we attach the wooden toggle of the tether line.

(1) We usually fix the bridle to the two bridle points with wooden toggles which enter into loops attached to the backbone. Thus, the dismantling, necessary for certain repairs becomes easier.

The Shutter. - It is easy to understand that due to the movements of the kite, exposure time will have to be extremely short in order to obtain sufficient sharpness. In practice, however, we didn't find it necessary to resort to exposure times shorter than 1/100 or 1/150 of a second. This speed was obtained by a guillotine-shutter which we constructed ourselves and which, when tested according to the method of M. de la Baume Pluvinel, described in the book by M. Agle as the ball method (1) gave us consistant results. This shutter (fig. 4) is made of thin wallnut wood board 0,002 m thick, ABCD, of which the width must be approximately twice the diameter of the lens and the length, seven times this diameter.

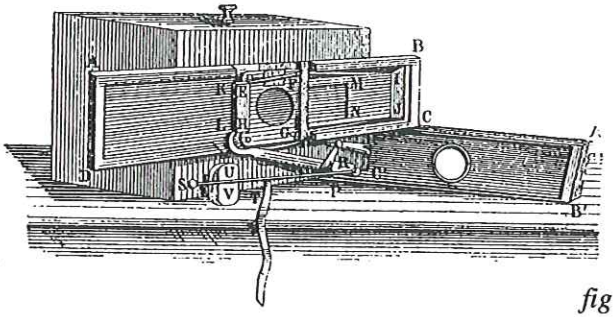


fig 4

In the middle of this board, we cut a circular opening of a diameter equal to that of the lens. On both sides of this opening and parallel to the long sides of board, we glue two strips of wood ground down to approximately 0,0015 m in thickness, 0,01 m in width and a length equal to the diameter of the lens plus 0,02 m. We cover these strips with a square board EFGH, the sides of which have the length of the strips. This board has an opening in its centre similar to the first one, and once it has been positioned precisely above it, it is secured by four screws. Between these two openings, we will have a slot where a light-tight board, also as light as

(1) AGLE, Manuel pratique de photographie instatanée. in-18 jésus, with several illustrations; 1887 (Paris, Gauthier-Villars et fils).

possible, will slide freely (1). It is important to remember that we no longer work on firm ground, with a tripod, but with a camera suspended in the air, to which the slightest impetus may cause movement. Inertia alone must give it the necessary stability. We are dealing with a phenomenon similar to the one observed when shooting firearms. At equal charge, it is the heaviest rifle which produces the least recoil, that is the one of which the weight, is in the highest proportion to the weight of the bullet. Thus, within the limits of the possible, the more weight we give our camera in relation to the weight of the shutter blade, or rather, the less weight we give to the blade in relation to the camera, the less motion we shall have to fear during the exposure. This blade I JKL must be honed down enough to slide freely within the slot; it has a square opening, FGMN in its center, the sides of the opening corresponding to the diameter of the lens. At one of its ends IJ, we will cut a bevel edge and we will glue two superimposed parchment-paper sheets of 0,02 m width across its width which will form, with the bevel-edge, a small notch intended to receive the rubber band used as a spring. This rubber-band, IEJH will be attached, either to two nails appropriately arranged, or to the board which forms the slot (2). The parchment-paper IJ will be honed down with sandpaper on the side facing away from the the notch, and will allow the shutter-board coming to the end of its run to enter the slot with force and to be secured by the elasticity of the parchment-paper, this preventing any bouncing-back (3). To maintain the shutter blade in its cocked position, we use a latch LP which turns around a screw. The short end of this latch, enters the slot at the point L at a very slight angle, and will partly close it in such a way that the pressure of the shutter blade alone, pulled by its spring, will not make it yield. At the opposite end of the latch there are two notches. One of them, R will allow us to attach a rubber band pulling in the release direction, the other P,

(1) Walnut, cherry, pear-wood are suited for this use, whereas poplar, pine, etc., must be banned, being translucent when too thin.

(2) We use narrow rubber bands of which we increase the number to suit our needs. Usually, two will suffice.

(3) Concerning this accident, see: La photographie en ballon by Gaston TISSANDIER, p. 26 and 27.

receives a tight thread, PS, which will maintain the latch in the shutter-cocked position. To be able to trigger the shutter while the kite is aloft, we will pass this thread through the end of a wick T, which we will light at the other end. It will glow slowly at the rate of 0,05 m per minute and, once the ember has reached the thread, it will burn it and the shutter will be released (1).

But if this shutter were to be exposed to diffuse light - or worse, direct sunlight for any extended period of time, it would let through light rays which would fog the negative. To prevent this from happening, we did not find anything better than covering the whole device described above with a box A'B'C' made of black cardboard. This box is fixed to the large board by means of two rubber bands and has a circular opening in its centre which coincides with those made in the board. Under such conditions, the only light rays which will penetrate the camera are the ones which normally pass when the shutter is opened (2). Since we placed the lens inside the camera, we will fasten the shutter directly to the camera having placed a piece of black cloth glued on both sides, between camera and shutter which will totally prevent light infiltration.

Release of the Shutter. - We have to choose between two modes of release, one elegant and ingenious which will allow us to operate the system at the precise moment considered favourable, but expensive, somewhat heavy and cumbersome: electricity. The other, simple, even primitive method will invariably function at the pre-set moment, regardless of whether the moment is ill-timed, either because the wind is falling, or because a cloud is masking the sun, but so light and so cheap that nothing else comes near it: it is the time fuse. It is this latter means of release that we prefer; and so much so that it is the one which we

(1) If we were to trigger the shutter electrically, the thread should be replaced by a rubber band, capable of resisting the force of the shutter blade. The latch would be covered with a strip of soft iron opposite to which a small electromagnet, strong enough to overcome the traction of the rubber band, would be fixed. As the current passes, the latch, attracted by the electromagnet, would unmask the slit and the shutter blade will be free to move.
(2) We left our camera in direct sunshine for more than an hour with its shutter cocked, and when we developped the negative, it did not show any fogging at all.

describe in detail. If, during our experiments, it sometimes operated untimely, we must concede that the wick never went out and that the release mechanism never came down without having been activated. Furthermore, its main advantage is its lightness. With electricity on the other hand, the two copper wires covered with silk or cotton, connecting the kite to the operator, will put a heavy burden on the tether line around which they are wrapped and thus, notably reduce the lifting power of the kite. Moreover, being less extensible than the tether line, they might snap when subjected to gusts, and the operator would remain helpless and without control over the apparatus. Finally, a battery and a contact button must be taken along by the operator and this excess of baggage is most inconvenient when operating the kite. We repeat it, unless there are special circumstances, we prefer the time fuse.

Choosing the Lens. - Which lens should we choose for aerial photography? Let us consider the conditions under which we are to operate, because that is the most appropriate way to find the instrument which suit our needs the best. We must photograph instantaneously; we shall thus have to be able to work without stopping down the lens or at least to a very little degree only. We wish to obtain photographs from which we can make precise measurements; it is thus necessary to avoid any deformation. The question put this way, the answer is easy. Aplanat lenses meet these conditions. For normal use, we will choose an ordinary aplanatic lens which, with an opening of F/17, will embrace an angle of approximately 40° with sufficient sharpness. If it becomes necessary to encompass a larger area on our negative and when we have reached the maximum altitude which our kite and tether line will permit us, we will resort to wide-angle aplanatic lenses. That way we will be able to cover an angle of 90°. But, in such cases, exposure may sometimes be found insufficient, unless we operate in very good light, as the aperture of such lenses goes, at most to F/15. From what we have said, it should not be concluded that aerial photography can only be approached with expensive instruments. A simple landscape lens, with sufficient aperture for instant speeds, will yield interesting results, mainly when we photograph at an angle. But,

as for all other types of photography, if we wish to obtain rigorously precise images, the instruments we mention are necessary.

Choosing the Photographic Process. - For the photographic process, we will have to choose between glass plates, films and gelatino-silver-bromide papers. The highest speed is the primary condition. In second place comes the matter of weight which must not be neglected when using kites. At equal speed, we will thus choose papers or films to glass plates which besides may break and damage the lens with their splinters if the descent is too abrupt. Film has the advantage over paper to have finer grain and maybe also a higher speed (1) - Therefore, we prefer film.

Reels and Tether Lines. - We still have to examine the tether lines and the reels upon which they will be wound.
As we already said, wind has a definite action on the line, and this action together with the force of gravity, forces the line into a more or less pronounced curve. The more we reduce this curve, the more lift we will give to our kite. To reach this goal it will thus be necessary, within the limits of the possible, to reduce: 1° the weight of the line, 2° its surface (its tensile strength remaining the same). We will choose a line made of the finest hemp and carefully twisted. Whipcord which is sold in balls, 80 m long at the price of 4 FR per kilo, is perfectly suitable for 1,50 m high kites. It is true that we could use a very thin and light steel wire for a tether, with a strength nevertheless superior to that of a hemp line, but let us not forget that, strung by the kite, such a wire is comparable to a sharp blade, capable of causing severe wounds in case of accidents. And precisely, to avoid such cuts that even a plain string could cause when slipping between fingers and also, to make operations easier and not run the risk of tangling up the line, we adopted a reel, easy to handle and costing next to nothing.

(1) Having tried several papers, glass plates and films, we finally settled for Balagny flexible plates made by Lumière of Lyon, of which the results appeared to us to be immaculate.

This reel is made of a hardwood cylinder 0,08 m in diameter and 0,05 m wide of which both ends, in form of tenons, are engaged in mortise joints made in the centre of two hardwood discs of 0,015 m in thickness and 0,20 m in diameter. Two wooden handles, which fall well in hand, are solidly fixed to the two discs at equal distance from the centre and permit quick unwinding and winding of the tether line. The latter is securely fastened by running it through a hole drilled in the cylinder, whereafter a solid knot is tied. One way of fastening, we prefer and whose usefulness we shall see later, consists in fixing a piece of line forming a loop to the cylinder by a knot. The line itself is then attached to this loop with a wooden toggle. This allows us to rapidly disengage the line from its reel when needed. A second toggle ends the line at its other end and allows us to connect it to the kite's bridle. Following several cases of rupture of the tether line, due to sudden gusts, we had the idea to place a length of rubber band, ZY (Fig. 3, p 122.) with a cross section of 0.005 m between the bridle and the line, and doubled three or four times. This modification yielded excellent results. As a matter of fact, instead of abruptly attacking the inertia force of the line, the wind gust will, thanks to the elasticity of the rubber band take a certain time to overcome it and thus distribute the force over a longer length of line. By excess of precaution, we also connect the toggle of the tether line to the bridle by means of a loose length of line, which would become useful if, by any chance, the rubber band were to tear.

III

WORK IN THE FIELD

We now have the necessary equipment, let us examine how to use it. Such as we described it, our camera does not have a closed plate- or film holder. So it is the whole camera, which we take into the darkroom to load it with sensitised material. The sensitised surface, cut to size will be fastened to the film board by the means mentioned above, inserted in the camera and secured as indicated. Then we place the lid which will be fastened with the two nails to secure it and the whole connection will be masked by two superposed wide red rubber bands. Without leaving the darkroom, we will put the shutter blade in its cocked position and secure it in this position with the shutter latch. The latch, in turn is secured by the thread which also goes through the wick. (1). Underneath the thread, we place the long pleated strip of paper UV (fig. 4) which will announce the triggering of the shutter. (it is essential for the operation that it ia pleated neatly.) Then we will stretch the rubber band of the latch which pulls in the release direction, and finally the one which pulls the shutter blade. We will then cover the shutter with its lid which is fastened with rubber bands at both ends. The camera must be built in such a way that sunlight does not penetrate it. However, if we were to cover a longer distance before reaching the operating site, it would be wise to wrap it in a piece of black cloth.

The tail of the kite will be placed on the back of the latter, passing it alternatively in the notches made at both ends of the reed or of the

(1) Usually we use a 0.20 m wick (diameter 0,005 m to 0,007 m), which gives us four minutes between the time of lighting and shutter release.

longerons. The operator, already carrying the camera, will hold the forward end of the kite while his assistant, carrying the reel upon which the tether line is wound, will take the rear end. This way, they will be able to reach the site, even in strong winds, not, we would say, in an easy way, but without damage to the equipment, which is the important point. A good precaution to take is to never present the surface of the kite to the wind.

After putting down the camera, the operator will put the kite on the ground and unwind the tall, while his assistant after securing the toggle ending the tether to a branch or a stake, will walk away against the wind while paying out the tether line. When 100 m or 150 m have been laid on the ground, the operator will tighten the line connecting the two ends of the bow (the stronger the wind, the more convex the side of the kite facing it will have to be in order to avoid swinging motions and jolts); then he will unwrap the camera and attach it to the bracket. He will pass the rubber band, folded as a hank, through the bridle loop and, connecting both ends of this hank by a common knot to the tether line at approximately one metre from its end, he will introduce the wooden toggle ending the line into the bridle loop. He will make sure that the lines are not caught in the camera or the shutter, he will light the wick and will note the exact time in order to know approximately when the shutter is released. Then, holding the kite by one side of the bow and by its lower end, he will present it to the wind and hail his assistant loudly. The latter will immediately run into the wind at full speed in order to ensure a good launch. As soon as he feels the pull of the line, he will stop and unwind the rest of it rapidly to allow the kite to reach maximum altitude. We insist on the circumstances surrounding the launching, because it is mainly here that accidents may happen, certainly more often than during descent.

Here we must mention an observation which has proved useful many a time. If, due to the violence or irregularity of the wind, the kite should experience jolts, some seconds before the shutter is due to be triggered (this being easy to estimate, as we carefully measured the wick and, took

note of the exact time), one should walk downwind at sufficient speed so that the kite has a tendency to descend.
Under such circumstances, it will recover its necessary stability to allow the taking of a photograph. This, of course, is only a palliative for rather rare situations.
As soon as we see the paper strip leave the kite, we will start the task of bringing it back down.(1). The operator who, after the launch, will have gone to his assistant, will press his hands alternatively on the line while walking towards the kite (2), Little by little the kite will come down and will be within hand's reach without jolts.
The operator will take the kite by the bridle from which he will untie the tether and the rubber hank and will lay it on its back to retrieve the camera which he will wrap up, taking care that the shutter blade cannot move back. To return, we shall make the same arrangements as for going to the operating site.

Development. - We shall not go into any details at all concerning the development; we take it for granted that our readers are fully versed with all photographic techniques. We will only draw their attention to two books, in which they will be able to find all necessary information concerning the development of plates having received a short exposure (which is our case). They are: Photographie instanée (3), by M. Londe, and Manuel de photographie instantanée (4), by M. Agle. However, we will tell them about a process which we used regularly with much success and which is within the reach of most amateurs: It is the ferro formulae development. This is our formulae, which develops slowly

(1) If, due to it having been badly folded, the paper strip should not unfold, it would be difficult to see it and thus be see that the shutter had been triggered; it would then be necessary to double the time calculated for the wick to burn before bringing down the kite.
2) A more elegant and faster way consists in running a small iron pulley fastened to a frame over the tether. The operator will take this frame and will walk towards the kite.
(3) LONDE (Albert), La photographie instantanée théorie et pratique, 2d edition. In-18, illustrated, 1890 (Paris, Gauthier-Villars et Fils).
(4) AGLE Manuel de photographie instantanée In-18 jésus with numerous in-text illustrations, 1887 (Paris Gauthier-Villars et Fils).

(a precondition for success in the case of instant photographs) and which does not fog the emulsion, not even after half an hour, on the condition that no irregular source of light has influenced the plate (1)

POTASSIUM OXALATE BATH
Neutral potassium oxalate 150 gr
Rain water 500 gr

FERRO-SULPHATE BATH
Ferro-sulphate pure 30 gr
Rain water 500 gr

For a half-plate we take 40 cc of ferrosulphate to which we add 45 cc of potasslum oxalate Then, to this mixture we add 6 to 7 drops of a 5% ammonia bromide solution. We shall add that, since the publication of the two books mentioned above, which are very complete, photography has been enriched with a new chemical, Hydroquinone, which seems to be marvelous for the development of instant negatives. A prerequisite for good results is to have chemically pure hydroquinone and to mix it in the developer, only with products prepared with equally great care. The principal merit of this new agent seems to be its ability to reveal details in areas where other developers remain ineffective. It works extremely slowly without ever fogging the negative. One understands that for our purposes, it may render great services, and we oblige our readers to try it (2),

(1) The photograph in this book was developed according to this formulae. We can add that, to be fully convinced of its performance, we took a sunlit view, on the 15th of November, at 10 a.m., with a Steinheil aplanat lens, aperture 18 with an exposure of 1/100 of a second. The negative obtained on Balagny flexible film was completely developed over 25 minutes and does not show the slightest trace of fogging.
(2) BALAGNY (George) Hydroquinone, Nouvelle méthode de développement.. In-18 jésus, 1889 (Paris, Gauthier-Villars et Fils).

IV

MEANS OF REACHING A HIGHER ALTITUDE BY ASSOCIATING A SECOND KITE TO THE ONE CARRYING THE CAMERA.

We have described the procedure for building the kite, for fastening a camera with automatic shutter to it and finally, for making it take to the air. Which altitude can a kite reach? This is the question we shall deal with now.

A kite of a given size will only carry a given weight. It does not matter whether this weight is distributed on its frame, on the equipment it carries or on the line, but it will not be possible to exceed it. This is so true that, if we launch a kite, it will rise until the moment where the line which has been paid out equals the weight representing its maximum possible load. From that moment on, it may move farther away, but it will be horizontally, it will have ceased to climb. We should not believe that with a kite of a very large size it would be possible to reach a higher altitude. The tensile strength of the tether line must be proportional to the surface of the kite. The ratio between the weight of the tether and the size of the kite will thus vary within very narrow limits only. Fortunately, we have found a way to circumvent that inconvenience. The journal, La Nature, of the 16th July 1887 carries an article about kites, written by Mr. Colladon, that explains this procedure. We launch a first kite. When it has taken up the amount of line it will carry, we attach the end of its line

to the back of a second kite, which in turn rises and increases the altitude of the first one by the altitude it may reach. We go on adding a third, then a fourth kite. Mr. Colladon, who was experimenting on atmospheric electricity, states that, with three kites, he reached an altitude of three hundred metres. We have repeated his experiments, and we can firmly confirm the results obtained by Mr. Colladon. The most appropriate way to attach the tether line at the back of the kite, and which Mr. Colladon neglected to mention, seems to us to be a simple bridle, placed symmetrically to the one used for the tether line. We would like to emphasise, that when using such a system, it is necessary to construct each one of the kites with the utmost care, and most of all to pay close attention to the absolute strength of their tails. Should one of the kites start spinning, the whole train would be in danger. Let us add that the safest way to choose lines in proportion to the traction they will have to withstand from kites of the same size is to give a single line to the first one, a double to the second, a triple to the third while reducing the length, in order to let each one of them carry an identical weight. Let us take, for example, three kites 1,50 m high. We give the first one 200 m of whipcord weighing approximately 500 gr; the second, 100 m of the same line, but double, also weighing 500 gr; the third, 67 m of the same line but triple, giving an identical weight of 500 gr.

Here, some operational explanations may be useful, let us take again the example mentioned above and let us suppose that the space available to us is only 100 m long. The assistant will unwind only 100 m of the 200 m of line wound on the first reel. In parallel to this line which is stretched on the ground, he will unwind a second reel (100 m of double line). Last, he will do the same for the third one (67 m of triple line). Each kite laid on the ground will be attached to its tether. After fastening the camera to the first one, the operator lights up the wick (which will have to be sufficiently long to allow the necessary time for the whole procedure). The assistant will, according to normal procedure, take the first reel and pay out the line as quickly as possible Then he walks with the wind to approach the second kite and hand over the first reel to the operator. The

latter will remove the line from it (by untying the wooden toggle from the loop on the reel which holds it) and place it in the bridle loop at the back of the second kite. Whilst this operation is carried out, the assistant will have come back to the second reel which he will take, and then launch the second kite, with the help, by the way, from the traction produced by the first kite. He will then approach the third one and the manoeuvre will proceed as for the second one. Getting the kites down will be done the same way, but in inverse order.

Before going into the study of practical means enabling us to know the altitude of the kite and the corresponding lengths of line, we shall describe a very simple process which we invented in order to get a bird's eye view on flat grounds, even in calm weather.

Procedure for Launching a Kite in Calm Weather. -Whether the kite remains immobile inside a mass of air in movement or whether it moves along in calm air, the result will not be different. Experience shows us that a wind blowing at 20 kilometres an hour is more than sufficient to lift a kite. This speed, which corresponds to one kilometre in three minutes, is easily reached by most trotting horses. If, in calm weather, we have a horseman riding away with the lower end of our tether line entirely unwound, we shall soon see the kite reach the normal altitude allowed by the line. A considerable area is not necessary for the rider; we may easily calculate it by multiplying the length of the line by 3.

Once, the photograph taken, the rider must come to a halt without letting go the end of the line. We will then see the kite descend so slowly and regularly that the equipment it carries will have nothing to fear. At sea, a steam launch may easily take the place of the horseman for such an operation.

This way, it is no doubt easy to take photographs at an angle. With the shutter we described, the speed at which the camera moves is not such that negative sharpness would suffer. But, in many cases, a photograph taken vertically would be of no interest, since it would only cover the

ground already covered by the rider. The same will not apply for photographs at an angle which, depending on the angle it will be taken at and on the altitude of the kite, will cover a much larger area at distances of 500 m, 1000 m, 2000 m, etc. in front of the rider. One advantage offered by this method is the possibility to aim the camera in all directions; flying on the wind, on the contrary, one direction (be it only one) remains hidden, it is to leeward of the camera where the lower part of the kite blocks the view.

V.

NECESSARY ELEMENTS FOR THE VERTICAL TAKING OF A PHOTOGRAPH

Whenever we want to photograph vertically, knowledge of two elements becomes indispensable: 1° the altitude of the kite; 2° the distance which separates the operator from the centre of its view on the ground .

If we wish to take a view of an area where we have no access, but of which we have an approximate idea of the external dimensions, we must first know the distance at which the lens will operate, in order to allow it to encompass everything that may be of interest to us. We must also know the distance between ourselves and the point above which it will work and which will have to be as near as possible to the centre of the area. Have we obtained a photograph? By which means can we take precise measurements on that photograph if we are ignorant of the distance separating the lens from the subject reproduced?

Let us examine successively the practical means of obtaining this indispensable information

Altitude of the Kite - The most precise means, albeit not the fastest, consists in fastening, next to the camera, a small aneroid barometer (0,06 m to 0,07 m in diameter at most), which we have re-designed and which we shall describe. The glass window of this barometer must come off easily. From a black sheet of paper, we cut a roundel, 0.007 m in width, which when slid under the needles of the barometer, will cover its face.

And we cut a segment of about one third out of it. From tracing paper we then cut a second, absolutely identical roundel which we glue to the first but applying glue to only half of their circumference. To the tracing paper we then glue a narrow strip, the two ends of which meet above the part of the circle we have cut off, the whole thing will look like a box without its lid. A box with a large circular opening in its bottom. This done, we copy on the tracing paper, in an opaque colour (Indian ink or Cinnabar), the scale of the barometer's dial, the line marks covering only half of the width of the ring. Then we cut in gelatino-bromide paper (of course sheltered from daylight) a roundel identical to the ones we just described and insert it between the other two, which is possible since they were only glued along half of their circumference. Because of the part which has been cut off, it is easy to insert the roundel, thus prepared with photographic paper, under the barometer's needle. We turn it until its division lines coincide with those of the dial, and we re-insert the glass which, squeezing the cardboard strip, will maintain the roundel firmly enough to prevent it from slipping or hindering the free movement of the needle.

Next, we align the index needle exactly to the barometer's needle, and insert the barometer in a small camera equipped with a shutter and identical to the one we use for taking the photographs. It carries no lens and simply has an opening of 0,01 m in diameter. This opening must be at 0,07 m or 0,08 m from the barometer. At the given time, the light entering through this hole will project the shadow of both needles and the shadow of the line marks on the surface of the photographic paper. The release of both shutters will be obtained from the same current or from two wicks having the same length. After developing the gelatino-bromide paper, we will obtain, in white on a black background, the line marks drawn on the tracing paper and, on the part not covered by those marks, the equally white image of the shadow produced by both needles: the index needle indicating the starting point, the barometer needle, the altitude of the camera at the time of release. We shall not enter into the details of calculations which allow to calculate the altitudes given by the

barometer's indications, we shall find them in the Annuaire du Bureau des Longitudes. Suffice it to say that, to know the altitude of the kite, in metres, with an approximation usually sufficient in practice, we will only have to multiply by 12 the number of millimetres of mercury indicated between the two needles. As an example, we can take the barometer print obtained at the same time as the vertical photogtaph printed in la Nature of the 23d of March 1889. The gap between the two needles corresponds to 10,25 mm mercury; if we multiply this number, 10,25 by 12, we get 123 m. We checked this result against the formulae given by Dr. Gustave Le Bon, page 56 of his remarkable book titled Les Levers Photographiques (Photographic Land Survey) (1), and we obtained 127 m. As we can see, the error is negligible and may anyway be attributed to the face of the barometer not having been copied with sufficient precision. Another method, utterly simple, but also less precise, consists in measuring the line and taking two thirds of its length. This measure gives the approximate altitude of the kite when the tether line, starting from the reel, describes an angle of 45° to the vertical. And, finally a method which does not require any new apparatus and which yields great precision when executed with care. Unfortunately, it requires a piece of information which we do not always have at our disposal. It is the knowledge of the exact length of a given object reproduced on the photographic negative. This length however, can be marked out on a level ground with two surveyor's stakes. We draw a perpendicular line from the middle of the line between them and, on this perpendicular line, we place the camera with which the photograph was obtained, while not modifying in any way its focussing. By trial and error, we look for the point where, on a ground glass, the two stakes have the same distance between them as the distance measured on the print. Once this is obtained, we only need to measure the perpendicular from its base to the camera. The resulting length will be identical to the altitude of the kite at the time the photograph was taken. Should we wish to have, without

(1) LE BON (Dr. Gustave), Les lévers photographiques et la photographie en voyage, (Photographic land survey and travel photography) 2 volumes in-18 jésus, with in-text illustrations; 1888 (Paris, Gauthier-Villars et Fils).

calculation, a scale for measuring various lengths on the negative obtained, we can put sticks in the ground at a one metre's distance on the line separating the two stakes. Everything remaining in place, we then take a photograph. The negative will bring the metre's length to the scale of the given print (1). When the altitude of the kite is known either by use of the barometer or by another means, it is easy to devise scales for various distances using the same procedure, and then to take measures on the prints obtained, which it would be impossible to obtain in any other way. But it goes without saying that the scales must always be produced with the same lens which is used for the picture taking.

The Distance Separating the Operator From the Point Underneath the Camera. - This information is essential if one wishes to photograph a precise spot. As a matter of fact, the operator holding his kiteline sees very well if he is too much to the right or to the left from the object he aims at; but he cannot estimate if his kite is in front or behind it. Therefore, he needs a method which permits him to act with certainty. Here are two of them: The first and, certainly the most precise, consists in sending an observer out in the direction perpendicular to the one of the wind. This observer, having chosen a position where he is able to see the object to be photographed, as well as the kite and the operator, will indicate to him, by signs, if he has to move forward or backward. For more precision, he could avail himself of a plumb-line of a special model which we found useful. This small appliance, which was built for our own experiments, is made of a light wooden frame 0,06 m wide by 0,40 m long. At its centre of one of the short sides, a plumb-line is suspended. Two glass plates glued to each side of the frame protect this plumb-line from the wind's influence. After bringing the lower part of the line between his eye and the object to be photographed, the assistant makes

(1) When we conceived this method, the book by Dr. Gustave Le Bon, mentioned above, had not yet been published. We strongly advise our readers to read it. There, they will find similar techniques, but infinitely simpler and more ingenious, described with brilliant clarity. Moreover, the book contains formulae of the utmost value for our experiments, in particular pages 56 and following.

signs to the operator holding the line, to move forward or backward until the kite is a position where it is covered by the upper end of the plumb-line. The second of these means, which may come in handy when we do not have anyone else nearby or when there is no convenient spot from which we can observe the object to be photographed, consists in placing oneself at a distance from the point we aim at, which is equal to 2/3 of the line's length; if the line starting from the reel describes an angle of 45° to 50° to the horizontal. Should the angle be only 30° to 35°, we should be at a distance equal to 3/4 that length. Needless to say that this method is by no means precise. Nevertheless, it may be useful.. To measure the angle between the line and the horizontal, we devised a small apparatus which gives sufficiently precise results. It consists of a square wooden frame the sides of which are covered with glass plates. On one of the glass plates, we glue a quadrant graduated from 0° to 90°. In the corner of the quadrant, we fix a silk thread at the opposite end of which we attach a lead pellet n° 00. If close to the reel, under the line, we fix the side of the frame going from the corner of the quadrant to the 90° mark, the plumb-line will indicate the angle between the tether line and the horizon on the arc. Thanks to the two glasses, the wind will not influence the movement of the plumb line.

VI.

USEFULNESS OF AERIAL PHOTOGRAPHY

Is aerial photography a simple curiousity, or may it really be of use? Today doubt is no longer permitted. We see most states creating companies of balloonists, all of them equipped with photographic cameras. But we believe that aerial photography will be put to far more uses thanks to the process we described here which thanks to its simplicity and the low cost of the equipment required, is within reach of everybody.

The explorer will not increase his luggage by much by taking along a 2 m long kite and a few kilos of line and, in most cases, a perspective view obtained from 100 m or 200 m will inform him about the course to take or the dangers to avoid. In a portable darkroom, he will be able to map inaccessible areas: islands, skerries or fortresses; or to bring back the exact images of those mounds (1) in Mexico, which should really be observed from the air.

We have hardly spoken of military arts, and yet, it is mainly here that we could find frequent and useful applications. With such light luggage, any marching unit would be able to scout an area with certainty.
Finally, thanks to stereoscopic photographs, which are as easy to obtain from a kite as ordinary photographs, everyone will have the possibility to indulge in the illusion of a perilous ascension and contemplate the

(1) Man-made hills, or mounds of several hundred metres, which their builders gave the shape of snakes, crocodiles etc.

World from above without taking any risks. Such photographs have the immense advantage of offering the possibility to perceive, with surprising sharpness, explainable by the feeling of third dimension, the finest details which on the ordinary photograph would pass unnoticed; which accounts for the illusion of relief.

We will mention, without much emphasis, the use that may be made of photography by kite in agriculture to record layouts of irrigation canals and the modifications which may be brought to them, to record phylloxera attacks and their advance from year to year, and finally to determine beyond doubt the limits between inherited properties and the public highway.

We shall not end without a few words about a method for which we believe that Photography by kite will open numerous applications. We want to mention the method imagined by Colonel Laussedat for rapid land survey with the help of two photographs. These two views, taken from two different spots separated from one another by a known distance, permit us, through cross-references, to establish the exact position of all points of the area seen from those two locations. But, if we operate on flat land, where can we find those two locations from where the camera can embrace a vast area? In this case, the photographic kite comes to our aid and, thanks to it, we will be able to take the two bird's eye views which will perfectly suit our needs. Orienting the two kites will be a simple affair, since both kites will be under the influence of the same wind direction. Furthermore, the direction of the lens can be changed to suit our needs by swinging the camera brackets. We do realise that if we are to obtain valid results, the cameras must operate from exactly the same altitude. We do admit that we have not yet reached this high mathematical rigour, but still hoping to attain it, we believe that with the control over altitude which, at present we have over kite and camera, it is indeed possible to render services in connection with land surveying. This indeed is an important application of the process which we have described above and which, let us repeat it, despite difficulties

which are more imaginary than real, must and will yield reliable results to those who will follow our indications.

APPENDIX

We do not believe that we have accomplished all possible improvements to our method for aerial photography. We have merely proved that success is certain, even with imperfect equipment. It is up to our skillful French constructors to create new models, which suit the new needs of photography. Let us hope that they turn their main attention to the weight of the camera we described which should be reduced, if possible, and most of all to a light and light-tight camera, indispensable for sustained work; and last but not least to the kite which it ought to be possible to dismantle to facilitate transport.

After we had gone to press, with his usual good-will, M. Henry Gauthier-Villars, put us in contact with the engineer, Mr. Ferdinand Pottier, well known to the readers of «la Nature», (1) for his fine studies on the theory on kiteflying.Thanks to the new models he revealed to us, and to the ideas he disclosed to us, we believe it ought to be possible to construct a kite which could easily be disassembled. It would only require replacing the paper with a light fabric fitted, at the four corners where the frame is inserted with strong pockets into which to insert the bow and the backbone. It would be easy with a system of tenons and mortise joints, or even more simply with a bolt to fasten the bow to the backbone. Doubtlessly, the kite's weight could also be reduced, which in turn would enable us to reduce its size. To this end, we carried out

(1) See la Nature of 7th and 21st of September 1889.

some tests, and while a 2 m tall kite, built according to the indications we gave, weighs 0,785 kg, we were able to build one of the same size weighing only 0,192 kg. but the latter, which flies quite easily with a 4 m per second wind, would certainly be torn to shreds in a 10 m to 15 m wind, very well tolerated by the former.

We shall not close without saying a word about the lenses. The photograph printed at the beginning of this book was obtained with a Steinheil aplanat lens; but we must admit that among French lenses, it is easy to find instruments just as good and at a far lower cost. In particular, we were able to try out two stereoscopic aplanats which were kindly entrusted to us for our experiments by Mr. Derogy, and which are in no way inferior in sharpness and most of all in luminosity to instruments made by the best foreign opticians. We would run the risk of being incomplete if we did not draw our readers' attention to two new books on development, published during the past months; we would like to mention: «Développement de l'image latente» by A. de la BAUME PLUVINEL (1), and the «Traité théorique et pratique du developpement» by Albert LONDE (2). They will give our readers valuable information about the rational way to follow in particular situations which may arise.

Finally, we would like to draw your attention to a coupling method for the kites which we have not yet been able to put to the test but which seems to offer serious advantages compared to the one we described. We would eliminate the bridle on the back of the lower kite and would have the tether line of the upper kite passing freely through it. (through a slit made between the two longerons at the fourth and fifth unit). This line would end in a loop which together with the bridle loop of the lower kite would receive the wooden toggle attached to its tether line. This way, the angle of the tether line coming from the upper kite would not in any way

(1) La BAUME PLUVINEL (A de); Le développement de l'image latente (Photographie au gélatinobromure d'argent). in-18 jésus; 1889 (Paris, Gauthier-Villars et fils).
(2) LONDE (Albert), Traité pratique du développement, Etude raisonnée des divers révélateurs et de leur mode d'emploi. (Practical Treatise on Development, Systematic study of various developers and of their use). In-18 jésus, with illustrations and 5 double-pages in phototype; 1889 (Paris, Gauthier-Villars et fils).

influence the angle of the lower kite and the latter, having a greater freedom would promise, not only improved lift, but also far better stability.

SUNDRY DOCUMENTATION

The kite which we used for obtaining the photograph in this brochure, has the following dimensions:

Length of backbone 2.50 m
Length of the bow 1.75 m
The wooden sticks of the longeron have a cross section of 0,005 x 0,03m.
The foils used for the bow are N° 5 blades.
The line surrounding the frame is hemp; it is 0,0035 m in diameter and weighs 7,70 gr per metre.
The total weight of the chassis, including the trapezoidal box for fixing the bracket is 1,055 kg.
The paper covering the kite is 0,201 kg
The bridle with its swingletree is 0,160 kg
The tail (12 m long), with double line 0,384 kg
Total weight of the kite 1,800 kg
Weight of the triangular bracket 0,237 kg
Weight of the camera ready to use 0,610 kg
Weight of the barometer and its casing 0,325 kg
Total weight of all equipment carried 1,172 kg
The tether line made of hemp is 244 m
It has a diameter of 0,0035 m.
100 m of this line weighs 0,770 kg.
Its total weight thus amounts to 1,878 kg.
The lens is a Steinheil aplanat, 11 lines and 166 mm focal length, working at full aperture.

THE END