Villas, Porto Rotundo, Sardinia, by Patrick Morin. Nikon 2000, 4m delta.

sources

If you can't find what you're looking for locally, try these:

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the aerial eye

a quarterly publication of the aerial photography committee
of the American Kitefliers Association
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Eglise de la Trinité, Cherbourg, by Christian Becot

KAP ELECTRONICS

the aerial eye

This newsletter is produced by the Aerial Photography Committee of the American Kitefliers Association. It is our goal to publish quarterly, in August, November, February, and May.

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Advertising is available in modules of 2.25 inches wide by 1.25 inches high, at $20.00 per module, payable in advance. Advertising in which aggressively competitive pricing is featured will not be accepted; call if you have questions or need more info. Camera-ready copy is not necessary, but is acceptable if it meets the above criteria. Copy deadline is the first of the month of publication. Contact Brooks Leffler.

send us that stuff!

As we start our third year of publication, interest in KAP continues to spread worldwide. We've added another dozen new readers since last issue. On the other hand, as we expected, we lost a few at the end of year 2. But this issue will still be mailed to 160 or so.

Half a dozen new contributors have jumped in for this issue, and if you're still procrastinating, we'd love to hear from you too. Deadline is the first of the month of publication (see left).

Text via Email or on 3.5" (9cm) high-density disk (Mac or IBM in ASCII text format) is preferred, but typed text or handwritten letters are welcome too. Likewise, diagrams in PICT, EPS, or TIFF formats are best, but pen drawings, preferably on white paper, will work as well.

Photos may be sent as negatives, prints or slides, or by electronic transfer—most of the time. We can also read Kodak PhotoCD, or 3.5" high-density disks in the formats listed above. We'll keep the prints unless you direct otherwise, but return all negatives, disks, CDs, and slides—eventually.

Send everything to Brooks Leffler at the address below.

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our feature this issue:

KAP electronics

by STEVE EISENHAUER

I know a little about electricity, and less about electronics. My cradle's wiring connections are all soldered, my ni-cad batteries are fully discharged before recharging, spare AA lithium batteries are in my camera bag in case the ni-cads fail in cold weather, one mini-servo trips the camera's shutter and another servo rotates it 360 degrees. Nothing I'm doing is electronically ingenious.

I did alter a servo once so it could turn 360 degrees continuously. With a 12-tooth gear on the servo shaft and a 4-tooth gear on the cradle's pendulum shaft, the servo would then rotate (pan) the camera slowly in either direction. By sending my S-VHS video camera aloft in this cradle, I could approximate the view of a hawk in flight looking slowly one way then the other then circling around. But this alteration was more mechanical (cutting out the tiny stops and one shaft nub from inside the servo) than electrical.

The articles and letters in this issue of AE put my limited knowledge to shame. You'll hear from KAPers, many of them new to these pages, in Canada, Great Britain, The Netherlands, Germany, and France, as well as several from the USA. You'll read about video-aiming, a walkie-talkie used to release the camera shutter, modifying a transmitter so it can be worn on your belt, electric shutter releases, rotary switches,and several ways to improve on standard R/C servos.

In reading about electronics in this issue of AE, I feel a great sense of relief. When our fledgling committee initiated AE in September, 1994, we had to include too much of our own writing and photography But our goal for AE was for it to become an open forum for ideas and information, not a podium just for our personal thoughts. We hoped to help crew a ship full of interesting and expanding personalities on a voyage of discovery about kite aerial photography.

I now sense that the AE ship is under full sail, the crew is motivated and capable, the passengers are supportive, and the wind is blowing consistently between 5 and 15 mph. • æ

about the cover

Eglise de la Trinité, Cherbourg, France, by Christian Becot

This rare night KAPhoto was taken May 31, 1996. The kite was Christian's own Crico III; the camera was a Konica Hexar, set at f.2 with Fuji ISO 1600 film. "The shutter was such that it could not use speed under 1/15th second," says Christian. He adds, "I framed with video, but it was not very clear. The white spot at the top is the moon, of course! The wind had sometimes gusts and there were blasts which shaked and rocked the cradle all the time. Usually at night, I never get enough wind, as it just faints with the daylight. That time, a storm was just going away, and I had enough." • æ

aerial video: get the picture legally

by STEPHEN JOINER (KC6QFR), North Hollywood, California

After being encouraged by a few mentions of aerial video in earlier issues of the aerial eye, I was sorry to read in the Winter 1996 issue that several of our mainstay contributors had apparently lost enthusiasm for video and sold or mothballed their systems.

The consensus seemed to be that video was intrusive to the KAP experience, and not the useful tool (much less the wave of the future) that I believe it to be.

Certainly there are pitfalls on the road to video Valhalla, and in the process of getting a Technician's class license and spending a few years putting ATV (amateur television) equipment and 35mm cameras on kites and helium balloons, I've stumbled into most of them.

Steve's video rig, sans 35mm camera. 915 mhz transmitter on left, video card camera below

All that trial-and-error convinced me that the licensed amateur route is not just the legal thing to do, but also the most direct—and, ultimately, the easiest—path to a serviceable video downlink that's neither a low-performance toy, nor a high-tech pain-in-the-neck. (Actually, I got a pain in the neck without video, from staring at the sky and trying to determine with any accuracy exactly where a 35mm camera at 450 feet is aimed.)

If you haven't been discouraged by what I and/or others before me have said on this subject so far, here are a few of the steps I have trod on the way to a practical video system.

1. GET LEGAL

Most video transmitters worth messing with are built for licensed ATV operators. To go on the air with one legally in the USA, you need a piece of paper from Washington D.C. that says you can.

Nevertheless, it has become common to see advertised in electronics publications a variety of micro-video transmitters tuned to operate on the amateur bands and even on vacant standard TV channels, yet many of these ads bear only a very fine print footnote—if even that—casually mentioning that a license is required to use their product.

Beware the temptations of operating such equipment "bootleg" (sans license), even in this era of Federal Communications Commission downsizing! The good news is that now there's no excuse not to get your "ticket" anyhow. You won't have to spend countless hours like I did only a few years ago learning Morse code. The No-Code Technician's Class license now requires only a suprisingly easy written test, for which study guides are available as close as your humble Radio Shack outlet.

When you pass—and learn a few useful things about transmitters and antennas in the process—you can downlink from a kite or other remotely-controlled aerial vehicle on alloted bands from 420 mhz all the way up to 2.4 ghz. And you can do so without

• *continued on page 20*

the "how" of radio control

by PETER van ERKEL, Amsterdam, The Netherlands

Most R/C systems used for KAP are so-called digital proportional systems with two, four, or more channels. "Digital" means nothing more than that the output of the transmitter is switched on and off. "Proportional" means that the the time the transmitter is switched off is proportional to the movement of the joystick on the transmitter case.

Each channel is represented by a pulsing signal, whose pulse duration depends on the position of the joystick. The output signal of the transmitter contains information for all of the channels in use, one after the other, in a so-called pulse train.

This is like a kite train, one pulse (kite) after the other, separated by a fixed time (connecting lines), preceded by a longer fixed time (the kite line). This signal train is repeated 50 or 60 times per second.

In the case of a two-channel system, the output of the transmitter is switched off and on twice every 20 milliseconds. Most systems use a pulse with of 1.5 msec if the joystick is in the rest position, 1 msec if the joystick is in the left/down position, and 2 msec if the joystick is in the right/up position.

The receiver on the other end does nothing more than detect if the signal from the transmitter is present or not, and reconstructs it if it is. This pulse train is then divided; this means the first pulse goes to the first servo, the second to the second servo, and so on.

A servo is an electric motor that through a reduction gear moves a potentiometer, or variable resistor, that is connected to an electronic circuit. The position of this potentiometer, through the electronic circuit, generates also a pulse signal proportional to the movement of the servo axle (potentiometer).

This pulse signal is then compared to the pulse signal from the receiver. Depending on the difference between these pulses, the servo motor is turned to the right or the left until the pulses have the same duration. When they do, the displacement of the servo axle potentiometer on the receiving end is the same as the displacement of another potentiometer connected to the joystick on the transmitter.

FOUR FOR THE PRICE OF TWO

When I first started to use an R/C system, I bought a Robbe Economic two channel set. This set is now sold as the Futaba Attack II.

Looking at the set at component level, I found that at the transmitter control circuit two inputs were not used, and in the receiver control circuit two outputs were not used.

Connecting a potentiometer circuit to the unused inputs the same way as the used channels brought the two unused outputs on the receiver to life, and I had a four-channel set.

If you are interested in converting an Attack II set to four channels, I can send the necessary information to you by mail since it would take too much space here.

• æ

customize your KAP transmitter

by PETER BULTS, Holthees, The Netherlands

When I started KAPing it was also the first time that I used an R/C model transmitter. I didn't like it. It is not designed for our needs and thus it doesn't meet the ergonomical standards that should exist for KAP.

These standards are, in my opinion:

- Fixed to your body in a safe way so that you have both hands free to do what is necessary
- Antenna on your back, controls in front of you
- Controls that stay in the desired position
- Small so that it is mobile

I had a Futaba F-14 R/C transmitter, and that made things a lot easier. In this transmitter the electronic circuit board is clearly laid out in two functional parts. One side of it is the servo-control circuit, the other is the radio transmitter. There are three connections between them: plus, minus and signal. At that spot I cut the board in two.

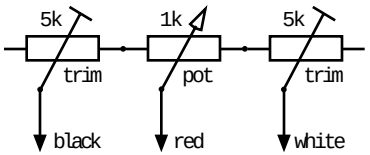
The radio transmitter part, together with antenna, batteries, and power switch, went into one box. That one was to be fixed to a belt behind me. The batteries are in the lower part of this box and act as a counterweight when the antenna is extended. The control part of the board was put in a smaller box together with the voltage indicator, which was attached to the front of the belt under my left hand.

Now to the replacement of the joysticks. As in most systems these sticks are made to turn one or more potentiometers (pots). In most cases these variable resistors have value of 5000 Ohms (5 kilohm). Normally such a thing turns 300 degrees. In an R/C transmitter the joystick uses only 75 degrees of it. This means that the variable part uses about 1.25k of the total. So in fact it is a series of three resistors; 1.875k (fixed) - 1.25k (variable) - 1.875k (fixed).

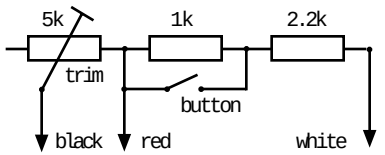
Since these values are not generally available in either fixed or variable resistors, I replaced the original parts with a 5 kilohm "trimmer" pot, a normal pot of 1k and another 5k trimmer. The only critical value is that of the normal potentiometer. It should be as close as possible to the theoretical value of 1.25k but not greater. This is important if you want to use the full 300 degree turn to position the servo and keep the exact 90 degree rotation of the servo. The trimmer pots should be at least 1.875 kilohm.

You'll need two of these replacement assemblies, one for pan and one for tilt. Install the normal pots in the control box with the shaft through the box. The central connection point of each of these pots is wired to the middle connection point on the circuit board. Each of the other points is soldered to one of the other points of one of the trimmer pots, which are mounted inside the box. From the central connection of each of the trimmers a wire is soldered to the left and right pin of the control board.

pan & tilt circuits



shutter release circuit

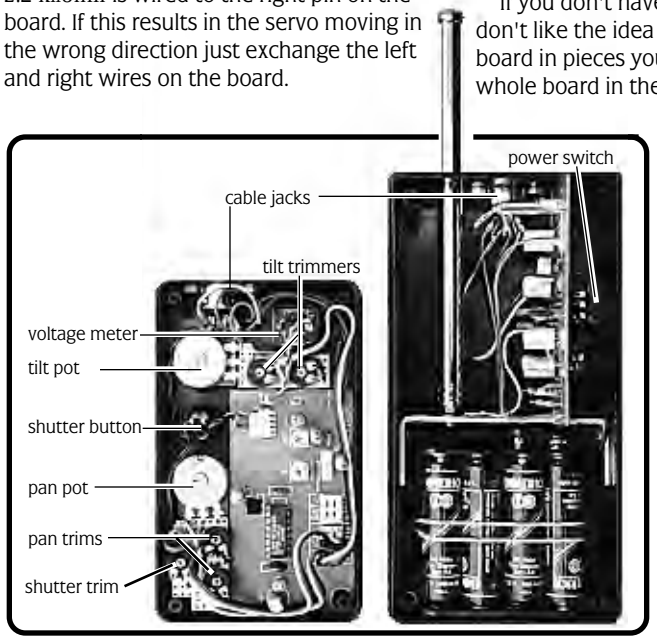


A special situation is the shutter release button. In this case I used a 5k trimmer, a 1k resistor and a 2.2k resistor in series. The 1k resistor is short-circuited by the button. The central pin of the 5k trimmer is soldered to the left pin on the control board. One of the other pins is connected to the middle pin, the 1k resistor and one of the button pins. The other button pin is connected to the point where the 1k and the 2.2k resistor meet. The other side of the 2.2 kilohm is wired to the right pin on the board. If this results in the servo moving in the wrong direction just exchange the left and right wires on the board.

The connection between the two boxes is a 5-conductor cable. For the Futaba F-14 that's enough. Two conductors are used to bring battery power to the control board. The other three are used to restore the connections between the two parts of the original board: plus, minus, and control. To complete the wiring you make the connections between boxes, boards and sockets. Since our equipment is used under difficult conditions, use flexible cable for this. Stiff wire tends to break easily.

Now everything can be put in place and adjusted. Just tune the trimmers so that all servos do what they are supposed to do.

If you don't have a Futaba F-14 or if you don't like the idea of cutting the circuit board in pieces you can perhaps put the whole board in the front box, and just have the batteries and antenna at your back. Or you can at least use the principles explained above to replace the joysticks with potentiometers. But be careful if you have modified the pan servo to endless rotation. In that case you need to use a pan control pot with a neutral center position like a balance control pot for a stereo system.



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walkie-talkie pushie-clickie

by CARL BIGRAS, 4530 Eighth Line Road, Carlsbad Springs, Ontario K0A 1K0, Canada

When I first got interested in KAP, I couldn't afford an R/C system. I came up with a bright idea; I wasn't sure if it was going to work but it did and it was inexpensive.

My Canon T-90 camera has an electric remote shutter release, and I wanted to trigger it electronically versus using a mechanical method. I used a set of Radio Shack walkie-talkies with a Morse code button.

The idea was to use the Morse code signal sent from one walkie-talkie to the other. Each unit has an oscillator circuit; when you push the Morse code button on one walkie-talkie, it transmits a signal (sine wave) to the other one, which comes out as a beep. As long as the button is pushed in, the other unit would beep.

Only one unit required modification. I cut and bypassed the speaker wires, and wired in a small bridge rectifier, which converted the sine wave (AC) to 5 volts DC at maximum volume. The DC output was then connected to a small microchip relay.

The relay contacts were connected to a 2.5 mm mini phone jack installed through the walkie-talkie case. A Canon remote cord about four inches long connected the walkie-talkie to the camera's remote shutter jack. The two microchips were glued together and located under the battery.

This was installed on my first camera rig, which was a very simple version from Pelham's Penguin Book of Kites [now out of print, alas—ed.], built out of plexiglass and a small camera ball head.

Now that I have a full remote control system for KAP, I still use the walkie-talkie for remote tripod photography.

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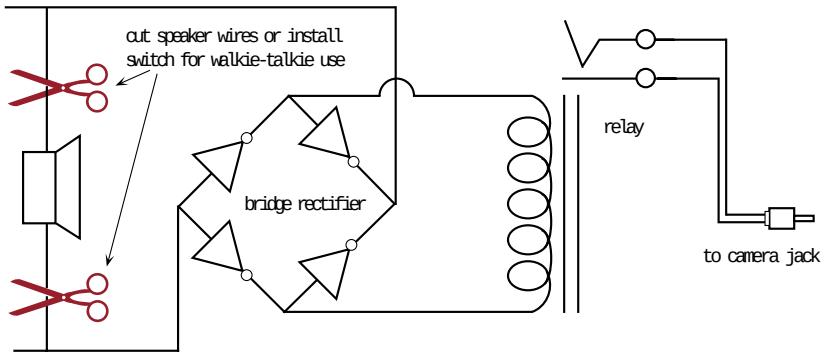


FLiBB'96: picavet über alles

text & photos by BROOKS LEFFLER, editor

No less than 30 KAPers (and kin) gathered during the second week of October for "Fesseldrachen-Luftbildtage in Bad Bevensen 1996" (Kite Aerial Photography Days in Bad Bevensen), or FLiBB for short (chief organizer Wolfgang Bieck loves acronyms).

Bad Bevensen is an ancient spa in the Ilmenau River valley about 80 km southeast of Hamburg, rolling root-crop farmland spotted with small forests of mixed conifers and hardwoods. Lovely country in the fall.

Participants came from all over Europe, some for the whole week, some just for the final weekend. Early arrivals included event co-organizers Ralf Beutnagel, Otto Böhnke, and Harald Prinzler and family, plus Norbert Gabriel, Hermann Graff, Ulrich Monsees, Christian Kolz, and Ralf Vehling from Germany; Dr. Christian Loibl from Austria; Peter van Erkel and Peter Bults from the Netherlands, and me from the USA. For the first four days, I was the only participant who didn't speak much german. Two of the Germans didn't speak any english, so when in doubt, german won.

We met at the Gustav Stresemann Institute, a conference center by the river Ilmenau at the edge of Bad Bevensen. Attendees from out of the area were housed there as well, and we took all of our meals in the dining hall of the complex. Our meetings and workshops took place in what was originally the jailyard of a 16th-century gothic courthouse, now converted to a good-sized meeting room with lots of wall space and a low beamed ceiling.

As the clan gathered on Monday afternoon, those who brought rigs with them hung them around the room. Our AKA/World Kite Museum traveling photo exhibit occupied one long wall, and individual KAPers succeeded in filling most of the rest of the walls with pictures. Monday evening was spent socializing and soaking up all this inspiration.

Tuesday started with Wolfgang's hands-on workshop building SUMIPIs (that's Bieck-speak for SubMiniature Picavets) out of sheet aluminum and miniature ball-bearing blocks. In the afternoon Ralf Beutnagel gave a slide talk about KAP modifications to compact cameras. Later we set

• *continued on page 24*

trigger your shutter electrically

by CRIS BENTON, Berkeley, California, & RANDY BOLLINGER, Ferguson, Missouri

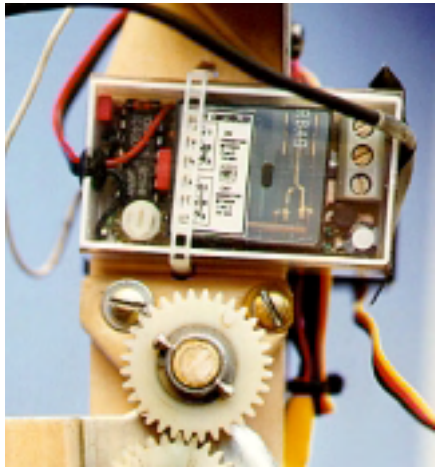
An increasing number of KAPers are triggering their camera's shutter electrically with a relay instead of mechanically with a servo, which makes the rig more reliable, lighter, and less complicated.

Several cameras have electrical remote control built-in, such as most Ricohs and some models of the Canon Rebel, but many compact cameras may be easily wired for electric triggering, such as the Olympus Stylus/Mu and the Rollei Prego.

Ralf Beutnagel did a slide lecture on this subject at FLiBB, and the main point he made is, don't be afraid to look inside your camera to see if it's possible to wire it for electric shutter release. (The otherwise excellent Yashica T-4, alas, is not an easy one to wire, according to Ralf.)

Two KAPers have sent in articles on this subject, which we have abstracted below.

The High Sky relay on Cris Benton's new Rebel rig



FROM CRIS BENTON:

One interesting aspect of the Canon Rebel camera is its small side-mounted electrical jack for remote control. The jack accepts a 3/32" sub-miniature stereo plug.

My local camera dealer kindly (amazingly?) let me disassemble Canon's wired remote control to check its workings. Sliding the remote's switch halfway closes a circuit between the stereo plug tip and the plug base. I assume this is the equivalent of pressing the shutter button halfway for exposure and focus lock. Completing the travel of the remote's switch adds the middle band of the stereo plug to the circuit. The camera's shutter fires when all three "zones" of the stereo plug are in electrical contact. The Canon can be placed in a mode where only one exposure will result from this type of switch closure no matter how long it lasts.

The next challenge was finding a means for the radio receiver to produce a similar circuit closure. Here I used an electric sailplane on/off control made by High Sky in Indiana [see box, page 11], which sells for about $20.00. It is slightly larger than a box of matches and weighs one ounce—about the same as the micro servo it replaces on my rig.

High Sky's device is basically a small relay that can be actuated by any radio channel. One end of the device plugs into the radio receiver. At the other end you can connect two wires to be either a normally-open or normally-closed circuit.

For firing the shutter I built a cable that connects the sub-mini stereo plug tip and plug base to one wire and the stereo plug's middle zone to a second wire. These wires are then routed to the normally-open connectors on the relay.

The relay has a small potentiometer that is turned to adjust the point in the radio channel's range at which the circuit is closed and triggers the shutter. The adjustment is sufficiently accurate that I use my rudder channel's trim tab for firing the shutter.

My High Sky relay has been used for about 10 rolls of film so far and it has worked fine for me. The one change I would make is to use a right-angle stereo plug that hugs the camera body, but I have been unable to find one.

FROM RANDY BOLLINGER:

...In KAP, every ounce counts...every amp counts. The use of an electronic shutter will provide a reduction for both.

...I found that Tower Hobbies sells a relay called the RAM Simple R/C Switch.... The advantage of this relay is not only weight reduction and lower amp usage. It will also provide us the opportunity to finish shooting a roll [when the batteries run down too far to operate servos] by using the rig in a fixed position. There's still enough voltage to operate the shutter.

If you're already using a fixed-position rig with one servo for shutter, think of the hours of shooting time you will have—your camera may go dead before your rig's battery.

. . . . . .

FLiBB participants using electric shutters said they felt that better results could sometimes be achieved with a two-channel sequential relay, with one channel activating the midpoint focus lock and the other triggering the shutter. Relays are available in Germany which will do this. We don't have source information, but Wolfgang Bieck can provide same. His address is on page 2.

Long ago in KAPWA TECHNIQUE, electronic KAPer Mike LeDuc of Cedar Rapids, Iowa, published a design for a relay of his own making, which could be modified to activate sequential relay outputs. I have used Mike's relays in two Rebel-based rigs I have built for others. Mike has promised to produce these relays (which he calls the Sure-Shot™ Radio Control Shutter Release Gizmo), but they haven't quite made it to production yet. Contact info for Mike is also included so you may pester him directly.

Elsewhere in this issue you'll find information on how to replace the joystick on your transmitter with a shutter pushbutton. This conversion is a natural partner to the electric shutter release. —bgl

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shutter relay sources

High Sky On/Off Controller:

High Sky
203 Bison Ridge
Nappanee, IN 46550
(219) 773-4705.

Sheldon's Hobbies (catalog)
San Jose, California
(800) 228-3237

RAM Simple R/C Switch

RAM
229 E. Rollins Road
Round Lake Beach, IL 60073
(847)740-5220

Tower Hobbies (catalog)
PO Box 9078
Champaign, IL 61828-9078
(800) 637-4989(217) 398-3636

Sure-Shot R/C Shutter Release Gizmo

Mike LeDuc
137 19th Street NW
Cedar Rapids, IA 52405

two channels—many functions

by CHRISTIAN BECOT, Tourlaville, France

Because we need pan, tilt, and shutter control, most KAPers are using four-channel remote control radios. Two-channel radios are much less expensive. With the addition of the multi-contact system to a 2-channel radio, all functions are available at reasonable cost.

The principle is to use one servo as a dispatching center for the control signal, and feed and control each function one by one.

To do this, a rotary switch is made from an electronic plate with copper coating on one face [i.e., a piece of blank circuit board material] which will be installed on the servo. An arm rotated by the servo supports twin metal blades giving different electrical contacts at each position of the arm.

For preparing the plate, you can scrape the copper coat with a small grinder mounted on a mini electric drill, or do it the professional way with acid.

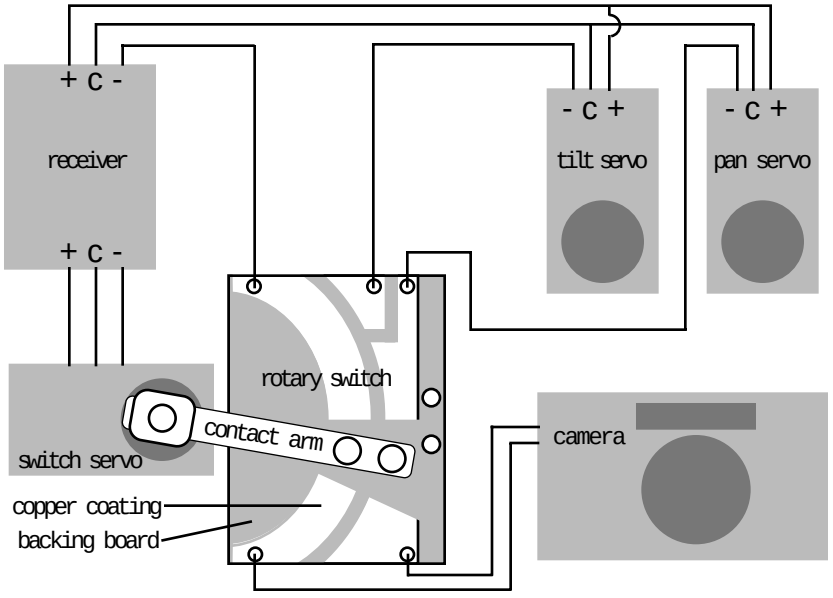
The diagram shows one example of this application. Many others are possible.

THE HOEDIC APPARATUS

Hoedic is a small island off the coast of Brittany in France. Pascal and Marie manage the *Fîle a Voile* center where you can make and fly kites. The island is car free!

You can also use their KAP rig which is controlled by a 2-channel radio and the multi-contact system here described:

The minus wire is connected for tilt or pan servos only when the arm is in the correct position. You may also switch the plus wire if you prefer, but never switch the control wire, or you will get troubles.



MONITORING THE FUNCTIONS

The multi-contact servo is connected on the throttle channel. The joystick is offset and trimmed so that the blades of the rotary switch are in the neutral position when the joystick is released.

A flick downward of the joystick will trigger the shutter.

Only when the joystick is held in either the pan or the tilt position is the relevant servo connected. At that time is its possible with the second joystick to command the servo. When the rig is pointing where you wish, you suddenly release the throttle joystick. The arm will quickly come back to the neutral position, and the pan and tilt will remain as they have been set.

ADVANTAGES

- cost is less than a 4 channel radio
- it is practical as your settings remain unchanged as long as you wish
- there are no modification at all in the transmitter, nor on the receiver or the servos
- you may imagine other additional functions
- you save batteries: only one servo is fed all the time, and it is working effortlessly
- the system can be combined with any other arrangement.

DISADVANTAGES

- The tilt servo is not under power all of the time. The consequence is that it will hold the inclination angle of the camera only by the inertia of the tilt servo.
- If the camera is heavy and the center of gravity has not been properly set, the camera may slowly tilt upward or downward. To avoid this problem, install a brake or rebalance the rig.

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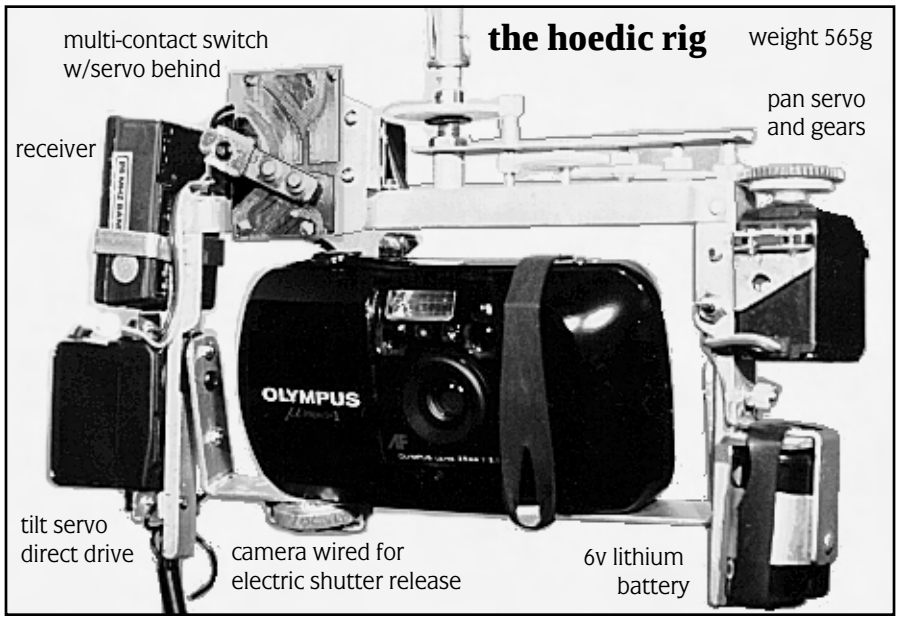
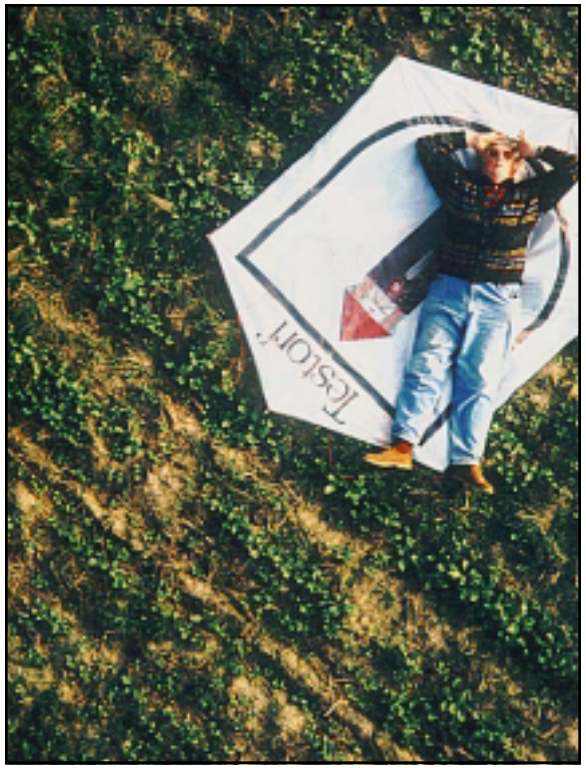


aerial gallery

▲ *Octadome by Randy Bollinger.*

▼ *My First Photo: Otto Böhnke, by Norbert Gabriel*



▲ *Three Iceboats, by Craig Wilson*

• *The Schnapps That Got Away, by Ralf Beutnagel* *Fishermen, Lagos, Portugal, by Frank Louwers*

your next camera could be an…epson?

by LARRY COTTON, New Bern, North Carolina

If I'm not badly mistaken, we KAP enthusiasts tend also to be gadget nuts. So when I spotted an ad for the new $500 Epson PhotoPC Digital Camera, I bit.

For those who don't know yet, a digital camera's pictures are electronically transferred to a computer and viewed on the computer's monitor. Environmentally nasty film, chemicals and paper have been replaced by the 'wares—both hard and soft.

Once the images are downloaded, they can then be sharpened, brightened, rotated and otherwise enhanced with photo-editing software. So let's zoom in (sorry!) a bit to see why digital cameras are particularly suited for KAP.

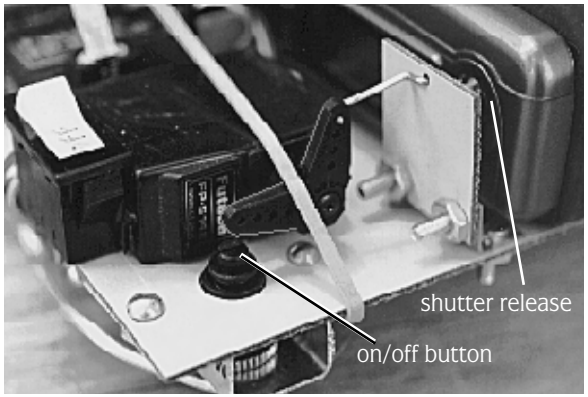
Main advantage: Using rechargeable batteries, you can take literally thousands of pictures and never use any consumables except electricity. The process is simple: snap the pictures, lower the camera, connect it to a computer and click on "transfer." With a laptop computer you (theoretically) wouldn't even have to remove the camera from the kite line. If the pictures aren't exactly what you expected, just reset the camera and/or rig and start over.

Another advantage: each picture is stored in a compact JPEG file (about 60K), perfect for casual KAP use and instantly attachable to your e-mail or publishable in newsletters, such as the aerial eye.

The Epson does have one annoying "feature": to conserve power it shuts itself off after a minute of inactivity. This requires some ingenuity in adapting the camera to KAP, with its requirements of low weight and maximum use of servos. The keys are to use the shutter-tripping servo to also turn the camera on and off, and to power the entire rig with one set of batteries.

The latter was easy, though at the expense of battery life. Normally the camera is powered by four AA cells, but will take an optional AC adapter. AC's a bit out of the question, but the adapter socket conveniently accepts a Radio Shack #274-1570 plug, which is then connected to the same power supply as the radio receiver and servo—four AA cells—via a push on/push off switch (Radio Shack #275-011).

Tripping the shutter and turning the camera on and off with the same servo were a bit trickier. But, as you can see in the photo to the right, the servo bellcrank's arms can turn the camera on and off when rotated counter-clockwise, then press the shutter when rotated clockwise.



If you decide to emulate this setup, mount everything securely (especially the camera!) onto a square of plastic laminate (e.g., Formica™). You'll have to play around with the spacing for your bellcrank, switch and shutter-release lever before you screw things down.

Should you consider other digital cameras? The Casio, which costs about the same, features a tiny LCD preview screen, but what good is this at kite altitudes? And their resolution is worse. The Dycam, Kodaks and Chinons are bigger, heavier and more expensive.

An exception: the brand-new Kodak DC-20, which, at about $350 is actually cheaper, smaller and lighter than the Epson, but it holds only eight shots at its best resolution (worse than the Epson) and its memory is not expandable.

There are other not necessarily KAP-related benefits of the Epson PhotoPC: it accepts optional camcorder lenses and filters; has a live-preview function when connected to a computer; takes a minimum of sixteen VGA-quality pictures; has expandable, though not removable, memory; and has a built-in flash.

The actual picture-taking process is more complicated than with a film-type point-and-shoot:

1. Just before lifting the camera cradle, turn on the battery master power and camera switches. (The camera will actually be off until time to take the pictures.)

2. Get the camera to proper picture-taking altitude.

3. Turn on the radio transmitter and move the channel control stick one way to power the camera.

4. Wait a couple of seconds and move the stick in the other direction to take the picture. Hold the stick in that position for a second, then release and wait ten seconds for the camera to scan and store the data.

If you wait less than one minute between pictures, repeat step 4; if you wait longer, turn the camera off with the radio, then repeat steps 3 and 4.

So how are the pictures? They look great on a computer monitor, but don't expect film-like quality on paper. Send me a request via email at

lcottonnewbern@worldnet.att.net

I'll be happy to e-mail you one back.

[The photo on the opposite page was sent via email to my computer, enhanced slightly in Photoshop, and reduced 10%, and I think it's quite presentable, even in B&W. —bgl]

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three ways to spin the rig

by HARALD PRINZLER, Schlangen, Germany, and BROOKS LEFFLER, editor

ENDLESS ROTATION

Usually a servo works in a range of about 90 degrees. Sometimes this range is not big enough for special applications, i.e. horizontal rotation of the camera-rig. To solve this problem, some servos can be modified to turn endlessly.

A modified servo will turn in the chosen direction as long as you push the joystick of your R/C transmitter. It will work in both directions. In the neutral position of the joystick, the servo should not turn either direction.

Open the servo-housing to get a view of the internal gear disks. If there is anywhere a half-round gear-disk, this servo cannot be modified for endless turning. If the gears won't work without being attached to the potentiometer, this servo cannot be modified either.

The turning of the gear is limited mechanically by a plastic stop on one of the gear-disks. Most times it will be the closest gear to the output shaft. By cutting off the stop, the gear can turn further on. The housing of the servo will still fit together so that the gear can work.

The next problem is the axis of the potentiometer, which must be disconnected from the gear. Some servos have a removable clip connecting the pot to the last gear disk; in this case, remove the clip. In other servos the potentiometer has to be removed completely.

If the pot can be used, first it must be set to the neutral position of the transmitter joystick. Then fix the gear in position by a drop of CA glue.

If the pot cannot be used, it has to be replaced by two fixed resistors. Read the value of the potentiometer and divide it by two. This will be the value of each fixed resistor. Most pots have a value of 5kW. So, the resistors may have a value of 2.4kW or 2.7kW.

Solder both resistors at one point together and connect it in place of the center-wire of the potentiometer. Connect the other end of each of the resistors to one of the other wires which were connected to the potentiometer.

Check the neutral position of the transmitter joystick; no servo movement should take place. If it does not work correctly, change the values of the resistors.

—Harald Prinzler

GEARMOTOR PANNING

In most of the 15 or 20 rigs I have built, like most builders, I have used a three-channel radio with 4:1 gearing between the servo and the vertical axle to give full 360-degree rotation. The movement is awfully fast, which is OK for small, light cameras but not so good for heavy SLRs.

Several years ago, Jim Day and I brainstormed a method using a two-channel radio to achieve full control of all functions. We've both used it successfully since.

The servo of one channel controls tilt; I recommend the left (vertical or "throttle") joystick because the motions are parallel. The servo for the other channel mechanically fingers the shutter button when the joystick is moved one direction, and when moved the opposite direction mechanically closes a microswitch, activating a small gearmotor which pans the camera continuously, one direction only.

I have built four rigs using this principle, and it solves the problem in an economical and efficient way, but it's not without its special considerations.

First is that a suitable motor is hard to find. It must be small, light, and geared low enough that it turns not faster than 30 rpm. Even that speed seems fast, but it's a lot slower than a 4:1 servo. I found one 40 rpm motor which was light and beautifully-made, but performed much better with speed reduced by a trimmer pot on the power supply, which makes it more complicated and less elegant.

Second is that gearmotors don't stop instantly, so it's easy to overshoot your target. Related to that is the most baffling problem (which John Carlson is running into in Antarctica): the motors I've used haven't had enough resistance to wind pressure on the rig, and it's difficult to stop the camera at some points of the compass—it keeps going a bit no matter what you do. Next time I'll add 2:1 or 3:1 external gearing, which should help with both of these problems.

Another consideration is that the shafts on these motors are usually quite slender and hard to adapt to the suspension system without custom-made fittings (but that gave me the excuse to buy a jeweler's lathe!).

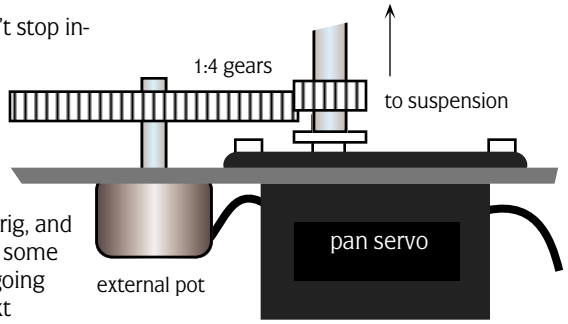
And finally, while I have successfully driven everything on the rig with 4-AAA batteries, most motors must be buffered with a capacitor across the leads to keep the servos from dancing like St. Vitus himself.

THE GEAR-DRIVEN POT

Otto Böhnke and others at FLiBB had rigs that were puzzling to look at: they had gear-driven potentiometers on both pan and tilt. Peter van Erkel was kind enough to explain to me what that was all about, and I'll try to relate it here. (Before reading this, though, read Peter's article on page 5.)

Here's the conversion in a nutshell: First remove the internal stops on servo gears and/or housing with a file or knife. Then replace the interior potentiometer on the servo with an external one. Drive this external pot at reduced speed with 1:4 gearing while direct-driving the rig's vertical axle, like so:

This amplifies the proportional reaction



of servo to joystick by 400%, fooling the servo into thinking it's moving the normal 60 - 80 degrees because the pot (which controls when the servo stops) is turning slower than the output shaft.

With this gearing, the motor should rotate all the way around 360 each way, though it won't keep going continuously. This modification also reduces rig rotation speed to a workable level and increases torque.

Assuming that your servo will accommodate an external pot, this is a brilliant, elegant solution, it seems to me. I stand in awe of whomever thought it up first.

— Brooks Leffler

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video • from page 4

having to keep an eye out for a windowless van sporting a government paint job, very plain hubcaps, and a direction-finding antenna on the roof.

2. GET SERIOUS EQUIPMENT

Once you're legal, you can stop struggling with mickey-mouse stuff like those low power, license-free "video senders" designed to transmit video from one VCR to another in the same house. Their output is anemic—you won't have to let out a lot of line before you've reached the fringe of useable range—and if you use one at any appreciable altitude, you are probably resigned to erratic results, poor reception, and so forth.

With ATV equipment, you have more than sufficient power at your disposal for a consistent, near-broadcast-quality picture. And, owing to the superiority of the circuit designs, you reduce your battery consumption and overall size/weight compared to the video senders.

These transmitters are available in either kit or finished form, depending upon the source, your available $$$, and your skill with a soldering iron. Meanwhile, when it comes to hi-res video cameras, all problems have been solved. You won't have to resort to unwieldy, surplus surveillance cameras bought at the local used-electronics swap meet, as was common practice until a few years ago.

Most of the mail order ATV dealers, and now many neighborhood electronics stores, offer black-&-white micro-video cameras (sometimes called board cameras), credit card size or smaller, weighing around 1 - 2 ounces (30 - 60g), and offering resolution equivalent to or exceeding that of Hi-8 or Super VHS. Some will run half the day on a 9-volt transistor battery. Stick it in a lightweight ABS case and it'll survive most any hard landing you can throw at it.

Leave the clunky security cameras to watch the parking lot at Walmart and conserve your available lift by getting a micro-camera with maximum technology and minimal dimensions.

3. GO HIGH FREQUENCY

For aerial activity, the higher the better, frequency-wise. While the Technician's license grants you the privilege to operate ATV as low as 420 mhz (just above standard TV channel 13), this lower band is congested with all sorts of individual and repeater activity. I prefer the neighborhood up around 910-916 mhz. Though such diverse activity as cordless phones and stolen vehicle locators are sharing this band, I've yet to experience any infringement on my video from these sources. Many of the video senders also use these frequencies but their power and range is so minimal as to represent no hindrance to ATV operation.

Signals in this band are pleasingly directional and immune to some of the sources of electronic noise which infect the lower band. They are also less likely to interfere with your R/C receiver, a real concern because it will probably be mounted only inches from the video transmitter.

ATV operators can step up a few more rungs on the frequency ladder, to the 1.2 ghz range, and even beyond, to 2.4 ghz. These are microwave frequencies and highly directional. When you watch live video from cars burning up the track at Indianapolis or Nurburgring, you're seeing microwave—uplinked to a helicopter or blimp circling overhead, then beamed back down to the TV truck.

The 1.2 ghz ATV stuff is getting small but the circuits still have a fairly large appetite for battery power so I'm sticking around 910 for now. But when I can step up to 1.2

• *continued on page 22*

contact, or no contact

by PETER BULTS, Holthees, The Netherlands

When working with electronics, success or failure depends on the quality of the soldering. Bad or so-called "cold" soldering joints tend to have a changing resistance and can cause annoying disturbances. Moreover, these spots are very hard to locate because you often can't see them.

So do it right the first time!

Never use soldering-liquids or paste. These products are not intended for our purposes. They contain acids that destroy the metals of the electronic components and circuit-boards. Only use tin-solder that consists of 60% tin and 40% lead and has a core of resin.

The only special equipment you need to do a proper electronics job is a soldering-iron. You'll need a simple iron of 25w maximum; 15w is better. To prevent the hot iron burning undesired holes in tables, components or clothing a holder is very useful. Some iron holders are also equipped with a little sponge.

Before you start soldering be sure that the parts to be joined are really clean. If necessary brush them with something like a wire brush or fine sandpaper, but don't use chemicals. The tip of the soldering iron should also be kept clean (that's the function of the sponge on the holder) to assure the heat can be transfered properly.

Before you start the soldering try to find a steady position for the two parts. You might fix them temporarily with something like clothespins.

The soldering itself should be done fluently. Put the soldering-iron on the spot so that it makes contact with both parts (see illustration). Now, less than a second later, let the tin-solder touch the heated spot. Keep it there only until the area to be soldered is covered with tin. Take the soldering-tin away and let the solder flow around the two parts until it looks good, then quickly remove the iron. Put the iron back in its holder and give the tin some time to solidify and cool before you move things.

The whole process is just a matter of seconds. If it takes more time the components will be damaged by the heat of the iron. It's a question of feeling and keeping up the momentum. Practice and patience will give you good results. And a perfect soldering-spot can be recognised by its silvery shining surface.

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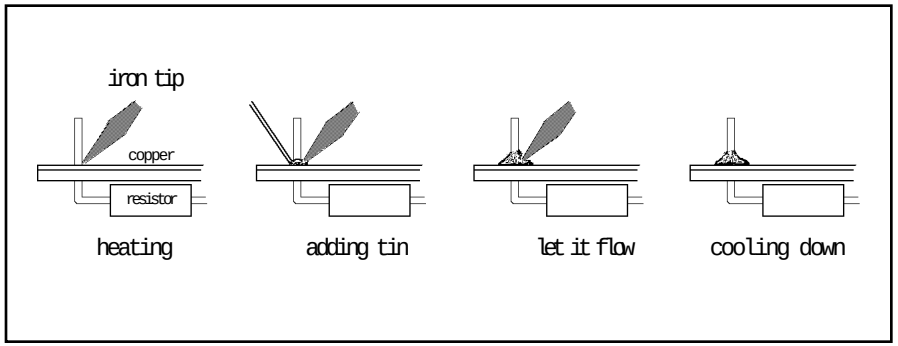

video • from page 20

ghz without draining my NiCads dry in 20 minutes, I'm gone.

4. GET A GOOD ANTENNA

When you're looking to enhance downlink performance, improving the antenna on the receiver beats boosting the power of the transmitter. The least desirable arrangement is whip verticals on both transmitter and receiver. Yet, in a KAP cradle configuration, the best most of us can do is a short whip or "rubber duckie" on the transmitter.

However, we can compensate by using a more efficient antenna at the receiving end, on the ground. (Yes, if you are determined to stay license-free and modify video senders for KAP use, this is the legal way to squeeze more range out of them.) A variety of choices are available from simple yagis, to discones, to high-tech heliphase units.

My current favorite is a home-made corner reflector, such as described in the July, 1996 issue of Electronics Now. This antenna is directional, but not in the extreme; just inclining it in the general heading of the aerial rig is sufficient to add 8 to 10 db gain in signal strength over and above what you would get with a 3-inch whip.

The antenna fits in a 10" x 18" box which I've attached to a 2-wheel dolly, along with the R/C controls and receiver and monitor, which are mounted on a tray at waist level. I simply roll this self-contained unit to the site, orient it toward the transmitter, and all that pure, unbroken video flows right to me.

5. COLOR, DIGITAL, AND . . . ?

Well, ready or not, color's already here. Color micro cameras with Hi-8 equivalent resolution are now available for those with a cash flow surplus. Thus far, they are all relatively vampirous in terms of power-consumption, but that will change.

It's only a matter of time before someone markets a high-resolution digital video camera and board mated to an appropriately modified ATV transmitter. Then we can downlink the live video image as "1's" and "0's" rather than the traditional signal components, record it on a tape or (more likely) disk, and input it into a computer—with zero image degradation from either the transmission or recording process. We can then manipulate, enhance, print out frames, or upload elsewhere, and the possibilities for KAP are endless.

This is not more than a year or two at most from general availability to ATV operators. I'm uncomfortable even writing about it in the future tense because, by the time this article is finished . . . .

SUMMING UP

It seems to me that the choice in developing an efficient aerial video system comes down to the short/hard way vs. the longer/easier way.

True, an investment of time and effort is required to complete the paper chase necessary for FCC certification. But once you do, a new world of efficient equipment and interesting frequency options opens up to you, and the sky is quite literally the limit from then on.

What a treat to rotate your cradle through 360 degrees at 500 feet altitude and enjoy a crystal clear, near-broadcast quality video downlink. While I value, for artistic and informational content (and as an exercise in delayed gratification), the 35mm still pictures I eventually get from a video-aimed Nikon, there is an immediacy to live aerial video that's the closest thing to flying dreams: rising above the treetops, floating on the invisible currents at maximum altitude, looking down and seeing all like the eye of the gods.

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using video

by ROB GREEN, Newbury, Berkshire, England

Having built the aerial TV camera with video sender, it proves inconvenient and impractical to use with my 10" portable TV receiver powered by car battery, unless I remain near the vehicle, although it has been possible on a few occasions.

I am currently looking for a small "tube" TV or LCD viewable in daylight to help me in producing well composed and accurately targeted still print photographs.

Sony produce a Walkman™ TV receiver which is very portable and will also record on 8mm video cassette, which would be ideal for my setup. I am using a CCD camera with built-in video sender fixed to a compact camera rig, all suspended on the kite line. This assembly could transmit live TV pictures to the Walkman and simultaneously record onto videotape.

These would make great edit shots on location during any ground-based video production using an 8mm camcorder, preferably being shot by an assistant videographer.

My rig uses a small Picavet using nylon curtain track pulley wheels and blocks. Controls are pan, shutter release (mechanical), CCD camera on/off, and pre-set tilt. The rig carries a Yashica compact camera and a CCD TV camera clipped on below, which is quickly removable.

The photo shows KAPer at the transmitter controls taking shots watching a TV monitor. The camera rig is airbourne and shows me at the moment of transmitter shutter release.

My transmitter is also indexed as a guide for a second more-complicated rig, which when not carrying the CCD camera can be tilt, pan, and landscape/portrait controlled at a glance if not visible in the air from any great distance.

I also have thoughts on mounting instruments like an altimeter, thermometer, windspeed indicator in front of the TV camera lens for a live coverage of conditions up there amongst the clouds—maybe even a pollution-measuring device. Who knows, the sky may not be the limit after all!

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in the spring issue:

KAP on the edge

KAP in the Arctic and Antarctic

& still more

KAP electronics

& technique

AD & COPY DEADLINE

FEBRUARY 1, 1997

FLiBB • from page 9

out for our first try at picture-taking in a nearby sugarbeet field, but few kites would stay up, let alone cameras.

After dinner, electronic wizard Harald Prinzler presented a technical session—in german—on his electronic interval timer, some of which will appear —in english— in the next issue.

On Wednesday it was cloudy when we left for a day in Braunschweig, a medieval city about 90 miles south, where Rollei Fotechnic, known best for their splendid (heavy) square-format reflex cameras, is located. Ralf had set us up with a VIP tour of the factory.

Quite unexpectedly, Rollei proved to be more like a guild hall with 300 artisans doing hand-work than a mass-production camera factory. To our delight, we were allowed to look right over the workers' shoulders and take pictures of anything we wished. Rollei topped off a splendid tour with an excellent lunch of roast pork, red cabbage, and dumplings, on the house.

The Rollei "Assembly Line"

After leaving Rollei, we were given a two-hour guided tour of the old city of Braunschweig. Ralf, bless him, had asked that the tour be conducted in english, which it was, fluently. We ended our day in Braunschweig with another hearty repast in a nearby rathskeller and drove home in the rain.

Thursday morning dawned cold and damp, and after breakfast we drove a few km south of Bad Bevensen to the village of Testorf, where Otto Böhnke had prepared a show-and-tell of his splendid craftsmanship: Picavet Xs, walk-down pulleys, line belayers, winders, and so on. He demonstrated his lathework by trimming the shoulder off a gear wheel for Christian Loibl.

Testorf's town historian led us on a walking tour through the village, to a potato storehouse, a woodworking shop, and a distillery where they made schnapps out of mashed potatoes, definitely not for the faint of heart.

After lunch, the day had brightened up a bit, and we traveled less than an hour southeast to the banks of the Elbe River, the former frontier between East & West Germany, for some KAPing. This time the wind was a bit stronger, though still fluky, and several cameras rose into the air.

Friday was to be a relaxed day, a time to explore Bad Bevensen or whatever we wished. Half a dozen of us decided to take the waters at the mineral baths for which the town was named. The outdoor pool was about triple olympic size, but only four feet deep, and warm enough to steam heartily in the crisp fall sunshine. Great way to start the day.

In the afternoon, we went to the nearby Elbe-Seitenkanal, a waterway which crosses both a road and a river on an aqueduct, to see if we could get some aerial pictures. (I know aqueducts have been around since Roman times, but it's still very strange to see barge traffic crossing a bridge.)

Unfortunately, the wind was light to nonexistent, and my rig, lightest of them all, wouldn't rise more than 5 meters off the ground, even with Otto's big rokkaku pulling it.

The weekend participants drifted in through the day. From Germany came Rainer Breuer & family, Ewe Pongs, Stefan & Siegfried Rummel, Gerold Tegeler, and Till Krapp. Frank Louwers came from Belgium; Annie & Jean-Louis Toussaint and Patrick & Kirsten Morin journeyed from Paris.

In the meeting room, up went the rigs again, and it was apparent that this was, as Wolfgang put it, "the biggest concentration of Picavet in the world"—only two of the rigs on display used pendulums. There were small ones and big ones, crude ones and elegant ones, heavy ones and light ones—almost two dozen ways to skin the same cat.

Before supper we visited Ropery Eilers for a tour, a local manufacturer for all manner of line, including kite line, and were each given 100m of their finest 3mm polyester (big kite stuff).

After supper, Harald and Ralf presented a very-informative how-to session on servo modifications, this time in both german and english, with Frank Louwers translating as necessary into french as well. Some of the servo modifications discussed appear in other articles in this issue.

Saturday morning was an official reception by the town of Bad Bevensen, followed by a lecture by Wolfgang Bieck on Scientific Applications of KAP, the complete text of which will appear in the next issue.

Then Wolfgang surprised us all by presenting his first biennial FLiBB Awards, complete with cups for the winners. These included prizes for Photography, Research, Innovation, and Journalism. [See box, page 25.] We are honored to have the FLiBB cup for journalism on our mantel.

After a tasty and filling lunch of goulash, potatoes, beans, and a nice salad, we went KAPing in a nearby sugarbeet field (below) with a lone barn and tree, and for the first time in a week, had both good wind and good light despite a partial eclipse. Lots of kites and cameras in the air this time. Using my light rig and a FlowForm 30 sans tail, I shot 14 excellent pix without film, and another 24 average ones with.

Sunday was cleanup day, with lots of casual conversation, packing up, and bidding farewell to new friends. Wind, once again, was marginal, but we flew kites without cameras in the field next door before ending the festivities in high style with a lavish korean dinner at the home of Wolfgang and Mong Hie Bieck.

"As an organizer," Ralf Beutnagel said when it was all over, "I have to say that there was no trouble in any way, and no rain, and all KAPers had a smile on their face."

And with good reason. The next FLiBB is scheduled for fall of 1998. Do it if you can. You don't need to speak german, but it helps.

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aerialetters

ANYBODY USING APS?

In a consumer magazine I've just received there is an article about the new APS camera/films. A quick read of this has convinced me that these are the way to go for KAP! The film can be changed mid-roll, you can take 2:3, 9:16 and 1:3 ratio shots (nice wide panoramas!), exposure information is recorded on each shot for the processing machine to read and adjust, and the cheapest fixed-focus model comes at around £35! There's also a unit which can read the processed film and play back onto TV.

Unfortunately, I'm neither a good photographer, nor yet an active KAPer, so I don't feel able to write anything about these cameras. I would be very interested, however, to see comment about them in **the aerial eye** some time.

Jim Cheatham
Guernsey, U.K.
jim@guernsey.net

JUST A KAPer

Talk about commitment! After reading the last issue (**æ** 2.4), I was very intrigued by all the dedication and hard work put forth by Robert Price with his research and article *Measuring Kite Characteristics*. I'm no aeronautical scientist, just a KAPer, but if I needed to know what the wind was at 100 - 200 feet, I think I would build a rig holding an anemometer and look at it with a microvideo camera, video sender, and monitor.

p.s. Also for the windmill rigs, a rotary switch may lighten your load. See Digi-Key source [*sources, p. 28*].

Randy Bollinger
Ferguson, Missouri

VICARIOUS SWEAT

I just finished reading the latest **aerial eye**—great stuff. Tom Burgener's article "watt happened" was quite vivid; I could almost feel the sweat pouring off me from running off across the cornfields.

I suppose just about all of us have had at least one instance of running after a dropped kite spool; I think my longest sprint was only 200 yards at best. This might be a good lesson to never let out your spool to the very end unless it is attached to something heavier than the line's breaking strength. If there is some reserve line, it won't travel quite as fast as the kite, so a fast runner at least has a brief chance of catching it before the spool runs out of line.

With the aid of the Rokkau tips article by Kevin Shannon, I hope to get the rokkaku that I completed last spring to fly good enough to be useful for KAP.

I found several little tidbits that will be useful to me. Not only is it interesting reading the adventures and misadventures of other KAPers, all is inspirational and makes me want to get out there and do it.

Henry Jebe
Douglas, Alaska

PICking PICTURES

After a long and interesting discussion with Peter van Erkel at FLIBB '96 in Bad Bevensen, Germany, about the effort of micro-controllers in KAP remote controls, I got the idea to open the discussion in **the aerial eye**.

Back home, I carried out some experiments with a PIC16C84 microcontroller and tried to evaluate the PWM-signal of the R/C receiver to control four output-lines with only one channel of the remote-control (for example to realise a two-step autofocus/release switch for electronic camera shutters). It works fine with the PIC running at 500kHz requiring a current of only 0.5mA.

Please understand this note as just one idea—it's surely not the first one. By the way—do you know the BASIC-stamp? It's based on a PIC-controller too and its programmable with a BASIC-dialect instead of using assembler. A very interesting, small, lightweight and cheap toy for microcontroller fans like me.

Uwe Martin Pongs
Aachen, Germany

BAILING OUT

In all the issues [of **æ**] I have never found a plan to build a Real Small Parachute, that can save a good camera & rig from ruins if & when it should break loose from the kite.

Do you have plans for one? Size should be 2' to 3' like the size that pulls the main chute out of the casing of a skydiver's pack....

The rig should be attached to the parachute which would be released from a light weight container in the event of a failure. The chute would also be able to ride down the kite line to the flier.

I plan to try out this idea and will forward the results to you.... Can you suggest where I can obtain [information] on the making of parachutes?

John J. Kaiser
1616 #3 Wood Crest Drive
Daytona Beach, Florida 32119

Most of the small chutes I've seen have been used to drop teddy bears and like fauna from kite lines, and they can be as simple as a circle of nylon with strings attached. If you'd prefer a deeper dome, you might simply copy the measurements of the gores of a small umbrella and attach strings. Any other ideas out there? Send 'em to John. —bgl

flibb-awards '96

Excerpts from Wolfgang's text:

PHOTOGRAPHY: Noriaki Hayashi, Japan

"...Extreme prospects and circumstances...signs good kite aerial photography. Photography—fraught with meaning—and technically excellent realization show Noriaki Hayashi as a kite aerial photographer worthy to be honored."

RESEARCH: Katsutaka Murooka, Japan

" ...In appreciation of specific kite-aerial-photography-equipment's development and the successful use of kite aerial photography in scientific archaeological research, Katsutaka Murooka is honored with the Research-FLiBB-AWARD 1996."

INNOVATION: Ralf Beutnagel, Germany

"...[He has] developed a new variation [on the Picavet suspension] named ... 'Type Rendsburg' and appreciated particularly because of [its] special camera-stabilization, [and] one special kite, named 'Dopero.' ...The handling characteristics of the Dopero added an excellent kite-type to a restricted number of usable kites for purposes of [KAP]."

JOURNALISM: Brooks Leffler, USA

"...Unique worldwide in the domain of KAP is [**the aerial eye**'s] production in color on computer exclusively and printed on ink-jet printer....In appreciation of his journalistic merits and his excellent engagement for Kite Aerial Photography... Brooks Leffler is honored with the Journalism–FLiBB-AWARD 1996."