

# The Olympic Specialists

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The

MobyCam invented by Garret Brown for the Olympic pool in Beijing - what will be used for the 'money shot' in 2012? MobyCam, Flycam, Divecam, Bulls-eyecam. Just the names alone put them in to an exclusive club. These are just some of the rigs that have bought us the moments that cameramen can't capture, in the recent Beijing Olympics games. These are the silent remote controlled robots that are whizzing overhead or down below or in hidden extremities. You've seen them in the pool, at the rowing, at the diving, at the canoeing, all kind of places and it's only when you've enjoyed the moment, you might say 'how did they do that?'

This year more than any other there has been added pressure for the riggers, production companies and engineers to deal with and that almost necessity is high definition. The IOC has been dogged in its insistence that smaller format cameras match up to the 2/3-inch mainstream sensor cameras that proliferate everywhere else. For one designer and inventor of such systems, Garrett Brown, that nirvana has finally been reached: "For the first time everybody matches, if you wanted one line from me about high definition its 'We match!' The IOC always demanded it but we never matched, we always did the best we could, there were still a couple of cameras in Beijing that didn't match because they are not high def yet, but it's more and more conspicuous."

## **Flycam, MobyCam and Divecam**

A lot of these rigging ideas were first thought of by Garrett Brown, who incidentally also invented the Steadicam rig, so obviously a man who thinks not just outside the box but on top of it, below it and round the back of it. "Divecam was first seen at the Atlanta Olympics as a commission from NBC, MobyCam was commissioned by NBC for the Barcelona Olympics and Flycam came after the Atlanta Olympics because we believed it was possible. In fact the

very first client was Pope John Paul who glanced up at it in Mexico City and, in doing so, conspicuously blessed it. Business was great after that! We were flying 500 feet above the central square in Mexico City.



The remote

FLYcam for the Olympic rowing “So after that Flycam worked in the Sydney Olympics doing four or five events and has basically never looked back. We use it in the States for the X Games in the winter and in the summer sports like BMX, in fact it was conspicuous by its absence in the BMX event in Beijing. We also had an opportunity to use it in the Grand National at Aintree in the UK but had a rather unfortunate encounter with MI5 who jammed all the frequencies when the Queen was there. We lost control of Flycam during the race – it became a cheerful little moron looking up and the sky and at anything but the race!

“Beijing wanted it after they saw it used in the Hungarian rowing championship and loved the way it looked.”

The way Flycam worked in Beijing was in the last 200 metres of the racing and it was the mixing of perspectives of the rowers below with the swooping feeling of the camera above going across diagonally that gave you this sense of wonder, “Making something that is working in two dimensions basically act like its three dimensionally agile just by the timing of its crossing is very hard to do.”

The meeting of technologies is also of paramount importance. Its one thing having the vision and the hardware to rig a camera on a cable but what if the camera is too heavy and affects the cable movement. The inventors of the HD Flycam camera system and it’s five-way gyro stabilized electronics are a small engineering firm in the UK called Bradley Engineering and David Bradley recalls how concerned the IOC was with the small format of his camera: “One of the concerns of the IOC was the quality of such a small camera unit but both they and the BBC have commented since on how it does stand up to the big cameras.

“Flycam were having trouble with the wind blowing the cable backwards and forwards and also vibration when they accelerated fast so we were able to provide a low weight solution. They bought their first Gyro 235 earlier this year when they used it on the Indian Cricket

League when it was stretch right across the pitch, then they bought another one and just after that we found out that they had got the Olympic contract.

“The camera is so small relatively speaking that when you see it in shot you don’t see. So there were lots of shots of the actual system in shot but because the ball is only 230mm in diameter no one really notices it.”

The transport for all these devices were at a very mature state anyway after past use, but it was still a challenge to fit a high definition head in to the stabilized body. Then you have the data pipeline which now is fibre optic in the case of MobyCam and Divecam. In the case of MobyCam its reinforced fibre because it is the cable itself that pulls this little submarine back and forth across the rails on lane three, Garrett Brown. “The rails are black rails, it’s a little black submarine that is less narrow than the lane line and the only visible feature is this little glass dome in the middle where the camera is.”



The diving cam procedure relied heavily on a simple gravity fed system When MobyCam was initially

used the cable had to be hand cranked, Garrett had to do that himself at the Olympics in Barcelona: “There was a great deal of anxiety that the Spanish electrical inspectors would have a look at motors near the water plugged in to the mains. So I cranked it by hand and of course it’s easy to pull a little submarine through the water with a hand crank but at the end of the games I worked out that I had cranked it 19 miles! Keeping up with the 50m sprint races was a lot of fun!

“Now it motorized and you sit next to a reel which is incoming and out going so you know where you are. They get used to the different colours of the floating barriers between the lanes and when the colours change. There’s also an automatic stop so it eases to a stop at the end.”

The IOC was initially nervous about using Divecam as they thought that something that big rushing through the water might produce a bow or pressure wave that a swimmer could hitch on to. Garrett had to show through a pool with coloured dye in it that Moby had no effect on the water.

“Now they have high def in there the pictures are quite amazing. If you’re pulling away in clear undisturbed water and then the swimmers dive in you see something that we saw in our low def world in Atlanta and marvelled at, to see it HD is a true marvel. That is this ‘Botticelli-like’ reverse image of the diver that is reflected in the undisturbed water. So the appearance that it gives looks like they are swimming in the air and as they return to the surface the mirror image seems to dive down and the instant that their heads break the surface, the head of the mirror image kisses the real head of the underwater swimmer the splash destroys the illusion.

“Early on in the case of the Mobycom I said to the swimming federation when they were debating whether this should be allowed or not, there were a lot of questions, ‘When you shoot swimming above the water it’s like shooting ice skating from under the ice’, everything important in swimming takes place under the water. Particularly a submarine like Michael Phelps.”

Rigging for Mobycom takes about a day as it’s a matter of getting scuba gear on with tanks to lay the rail and then the cable which comes up the side of the pool under some covers to the control point where the reel spool, the drivers and the operators are. It’s a real team effort between the driver and the operator to get the rights shots.



The pool end

of the diving cam On the Divecam there's a very old technology in use called gravity: "You have the puller who is watching the pelvis of the swimmer on a monitor, no other body part will do, you can't watch the head or the legs as they're moving too quickly depending on what dive is being performed. So as soon as the pelvis starts to drop you can confidently let go of the thing and as Galileo proved it falls at the same speed as the diver. If you tried to motorise it you'd be in to an absurd amount of engineering and noise. Part of the joy of these things and the challenge is you can't just drop a camera, you have all these constituencies who are looking at what you're doing. The security people, the look people, because it can't look hideous (in Beijing the Divecam operator was hidden behind a circular wall), it can't make a noise and distract anybody, it can't be unsafe in any possible way. The great tightrope

act for inventing this type of invention is not merely to get it to work in the crude sense but to get it to work in a way that is pleasing to all these different parties.

“In all these applications it’s the wide angle effect that is more pleasing. Being close and wide angle makes you feel like you are there.

## **Lenses**

For these smaller format camera devices picking the right lens can be the difference between getting the ‘money’ shot or not being revisited by the director. Bradley Engineering does make another version of the HD Flycam camera with a B4 mount so any broadcast lens can be used. The camera also has all the remote plugs on the top of the camera so you can achieve full control of pan, tilt, zoom, iris focus.

James Daniels of Camera Corp was out in China and describes their lens decisions: “We had 60 pan and tilt heads of a new design in China which have proved to be excellent with both hand held HD cameras and smaller POV cameras. We used two main types of lens both Fujinon models. The 13x4.5 model was modified with a different motor drive system to reduce the overall size of the lens. This has been our wide angle lens used in 26 remotely controlled weatherproof systems around the city with one in Hong Kong being remotely controlled from here in the IBC!

“For general use we have used the Fujinon 18x7.6 HD lens, which provides a good zoom range while still having a reasonably wide capability. Many of our remote heads have cameras and lenses, which are provided by the OB trucks at a particular venue. This means we have to make sure that our remote heads can handle any make/model of lens.”

A new slow motion camera Sprintcam, a co-development between Photron, Fujinon and Belgium company I-Movix, was used in Beijing and Founder Laurent Renard explained the importance for them of lens choice: “We're using a 1.2 inch single-CMOS sensor on the Photron SA-1 with 2/3 inch HD lenses with B4 bayonet adapter. The choice of HD broadcast lenses is therefore crucial. We've developed together with the Fujinon company a wonderful integration of a dedicated B4 adapter for our needs. We encourage the use of the Fujinon HD (box-type and ENG ) lenses especially for two different aspects. First of all, we encountered about 15 percent less ramping effects with the long focal length than with other brands, and second point, the PF autofocus features of their broadcast lenses is a huge advantage when the cameraman needs to follow moving objects in super slow motion.”

## **Cameras**

With the IOC’s resolution police ever vigilant it was the matching of the remote cameras to the main feed that was the acid test for many of these specialists. James Daniels again from Camera Corp: “We have been using a wide range of camera makes and models in China. For the highest quality combined with small size we use the Hitachi DK-H32 cameras. These provide 1000 lines of resolution and have comprehensive CCU control to allow accurate colour matching to any make/model of OB truck camera.

“We also use the Hitachi HV-HD30 cameras in our underwater pan and tilt systems. These are three chip CMOS cameras, which still provide a high quality image with excellent CCU control, while being even smaller.

“For smaller pan and tilt systems we use our own design of mini HD camera based around a Sony CCD block. We placed these on the top of the Pole Vault bar and for the first time had a camera in this position which had a zoom lens! Another 38 of them were used in various

places where a very small camera was needed. We also use the new Toshiba IK-HD1 minicam in the baseball bases to get the same shot as we have provided before but in full HD.”

Bradley Engineering had the Flycam camera and one other used by aerial company ACS. They didn't however have the problems that ACS had in getting their gyro systems to China. Because ACS were using American Gyro designed gear they had great difficulty getting an export license. But Bradley use all their own homegrown technology so had no export problems.

They also build their own cameras with 'bought-in' sensors and then build a camera around the sensor. For the Flycam HD camera they bought a very small sensor and made the electronics in turn very small resulting in what David Bradley calls the 'smallest all in one HD camera in the world'. Iconix may argue that claim but they only include the head in any 'smallest camera' bragging. For this particular camera there is an integral lens with about a 10:1 zoom but the iris is in steps rather than a continuous movement. HD-SDI comes out the back.

David Bradley explains where their particular expertise lie: “Our thing is remote control so there isn't a viewfinder or any operational controls on the camera itself. These systems can get smaller, however we are having manufacturing difficulties with one of the boards because it is so small and has so much on it. I think we're at the limit of the technology in the UK to be able to physically build the boards. The Japanese can do it better but they need volumes of tens of thousands. I think at the low volumes that we produce we're at the limit of the technology.”

## **New ideas**

You can bet that now the games are over there are many producers thinking of weird and wacky shooting ideas for 2012. But as Garrett Brown pointed out “What do you think they thought when I said I would drag a small submarine below lane three of the Olympic swimming pool!”

Every company involved in this type of shooting has got a 2012 plan, including James of Camera Corp: “Of course we are always looking for new ideas to give producers the ultimate 'shot of the games'. In China the biggest problem has been to get the same shots we have provided before but in full HD! One of our biggest challenges was to provide the Archery 'Bulls-Eye' camera in HD which we have done in the past using a small 6mm diameter single chip SD camera in the bulls-eye. There are no HD cameras this small, so we had a special lens made for us by Abakus in the UK which was 180mm long by just 10mm diameter tapering down to 2mm diameter at the tip. This provided some stunning shots of the arrows hitting the target, although we did need quite a few spare tips for the lenses! This lens fitted on to one of our Toshiba IK-HD1 minicams.

“We also used the Iconix cameras in our underwater Polecams, which as always provide great shots in swimming and diving.

“The thing we are missing most in the HD world is a really small RF system which can allow us to place mini cameras where cables cannot be used. Although there are some RF systems available that we have used here in China, for instance with remote pan and tilt systems in the fences at the Equestrian horse jumping, there is still nothing small enough in the RF world to allow us to put cameras on the competitors themselves.

“Probably some of times when a producer asks for a camera in something like a baseball bat or ball, or like the winter games when we have been asked if it was possible to put a camera in the ice hockey puck!

“As for technology helping us forward, well for me it is the change from tubed cameras to CCD blocks, but that's because I go back a long way! The biggest quality improvement has clearly been moving from analogue transmission to digital and the change of format from 4:3 to 16:9. With HD we are now getting small cameras that are in native 16:9 format whereas in the past there was nothing available in SD without the quality reduction of format conversion. Now we are achieving really excellent high quality pictures from mini cameras where in the past everybody had grown to accept the low quality that went with that type of shot.”

i-Movix and their Photron/Fujinon 1000 fps camera came in to its own when it recorded the moment when Michael Phelps touched first to win his seventh gold medal. To the naked eye the result wasn't clear but with 1000 frames per second at its disposal Sprintcam shown the result before officials could award the placings.

Founder Laurent Renard: “Did you see the Phelps race for his 7th gold medal? Did you see these wonderful images taken at 1000 images/sec from the swimming pool roof? I wish we could take these images even during nights in stadiums. In this case, our systems will be integrated in every big sport event in the world.

“We use Photron's SA-1 cameras because of their excellent light sensitivity, reliability and colour matching settings. We will get a lot of improvements to our products within a few months and also another product range within one year. We're currently making some research and development about a real-time anti-flickering filter to shoot images in stadiums during evenings and nights without bumping luminance. As for what we want in the future, how about wireless transmission at thousands of images per second... and we could make it!”

Bradley Engineering are currently working to capacity but are not frightened of any challenge put at their door, Dave Bradley: “We're currently just about to deliver nine HD cameras to the BBC for their *Big Cat Live* series of programmes. They are infrared switchable as well. They're all HD, fully remote devices and will be used remotely over about 20k, we didn't do that bit though it was SIS, the ex-BBC OBs. For one version of our Gyro 235 we put a camcorder in there. That's the easiest and cheapest way of doing it as downlinks are still very expensive and the main issue with links for remote applications is the latency. The difference in time between an operator pressing a button and it being seen on screen is a problem, it can be half a second delay which is not usable.

“I think the big technological advance has been in CMOS technology and I'm surprised that manufacturers are still producing new 3-chip cameras because the CMOS sensors now have just got all the resolution you could want. You don't see Canon or Nikon or any of the stills manufacturers using 3 chips or CCDs. I don't see any reason why those companies can't produced sensors for moving pictures and if they're not I'd be surprised.”

Garrett Brown has licensees for his inventions in the US and Australia but that doesn't stop him dreaming up new uses for technology, especially the Molecam and the Dragonflycam: “I have a couple of shots in my hip pocket that I'd love to make. On our website we jokingly referred to a Molecam which was a pure bit of whimsy but I've actually had people calling me trying to book the Molecam. You know it digs underground when it hears some action and then pops up to shoot. I'd like to do a camera hiding under the in-field rail in racing, just ten to fifteen feet out in front of the lead horse, low and wide angle. Also capable of sending a high def image back somehow by fibre optic with microwave or something like that.

“More miniaturization is needed, which allows our gadgets to be less conspicuous. I’ve seen talk in the last ten years about robotic ‘Dragonfly’ type cameras. Dragonflies are interesting because of the double set of wings that gives it an inherently stable platform. I bet that in my lifetime there will be remotely controlled, directable cameras the size of Dragonflies that are buzzing along with every runner on the track looking over their shoulder. There’s nothing stopping that stuff from being the size of a fly. As soon as you have the microwave technology to get the image and discriminate it from all the other little flies you’ve sent out there. You need to stabilize the image and control it. I have a camera already in my iPhone that would fit cheerfully on-board a robotic Dragonfly with a lens a 1/16th of an inch across at 2 megapixels.

“This stuff is coming, it’s a fact that most of the audience is not sitting there watching it, it’s sitting out here watching on increasingly bigger screens and better pictures. In our future you’ll get 4k equipment the size of an iPod, I’m absolutely certain about that. You may have to jump through some hoops to get the data but RED did a very clever job with the Redcode and that squeezes the pipeline down to a point where you could be talking 2K. I think the future of all of those things isn’t going to be the use of raw data but more the use of more sophisticated compression.”

There was a question at the Olympics about the use of the RED camera. David Bradley has had some experience with it in his sphere of engineering: “We’ve been asked to do the remote controls for the RED camera but they’re very much PC software-based which doesn’t suit TV people who don’t want to wiggle a mouse they want to twiddle a knob. So they would be much harder to integrate than other cameras.” James Daniel of Camera Corp commented: “We don’t have any experience of using this type of camera. I don’t think the CCU control would be good enough though for matching with broadcast cameras in live TV situations.”

In a word that’s the heart of the HD broadcast Olympics matter. Now that all the cameras seem to be matching, more sustained use of remote cameras will be seen. Anything else either higher resolution or lower will soon be voted off.

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