Introduction

This research paper is intended to be referred to as a resource handbook for film students and industry professionals looking to expand upon their knowledge of Steadicam. This project is aimed more at people within the film industry and as such the author assumes that many of the camera terms and equipment mentioned are known to the reader. There is an extensive glossary of terms at the back of this handbook and additional information may be found by referring to some of the texts listed in the bibliography.

Figure 1 535 on IIIA

In this resource handbook I will first begin with some Steadicam history, I will introduce its inventor and then talk about its feature debut. After this introduction and background material there will be a section that covers extensively the physics involved and how the Steadicam actually works.

Figure 2 EFP Don Juan

The Steadicam is a specialist shot making tool; and as such it is only good in certain applications – when it is the right tool for the job. This will all be covered and examples of good Steadicam use in feature films will be provided.

The key to operating a Steadicam correctly is balance. I will explain both static and dynamic balance – the differences between the two, and what is needed to achieve a particular shot.

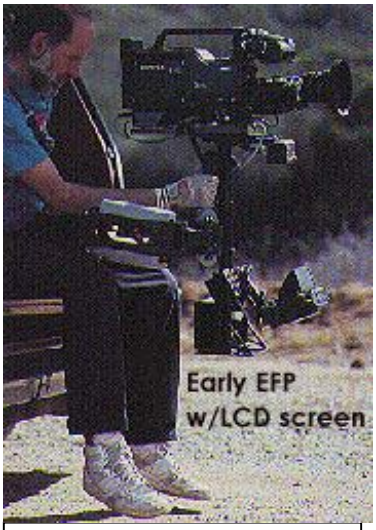


Figure 3 EFP Ted Churchill

There will be a thorough section on Steadicam arms. Covering not only all of the various models, but also their maintenance, safety and upgrade paths. Opinions from two of the world's foremost Steadicam figures will also be included.

There are Steadicam models available from two manufacturers, the differences will be highlighted. Following on from this there will be an extensive listing of the different features found on each Steadicam model from Cinema Products. To complement this I will do the same for George Paddock Incorporated, by introducing the system then listing the various products and features. This section will end with a head to head comparison of the respective models.

A section on accessories will cover what is needed on set, along with accessories that are desirable in that they make your life easier and may enable you to deliver better results.

Figure 4 Geoff Mart "The English Patient"

I will explain the various ways to become a Steadicam Operator and in this section I will include some literature from Cinema Products referring to their Steadicam Workshops.

Physical requirements and some good on set advice for the new Steadicam Operator will be covered, along with how to work with Steadicam Assistants.

There will be a brief section covering the cost of hiring an Operator and rig.

This Resource Handbook will conclude with a look to the future. Possible new developments within Steadicam and the threat of new technology will be addressed.

Figure 5 BL on Model II

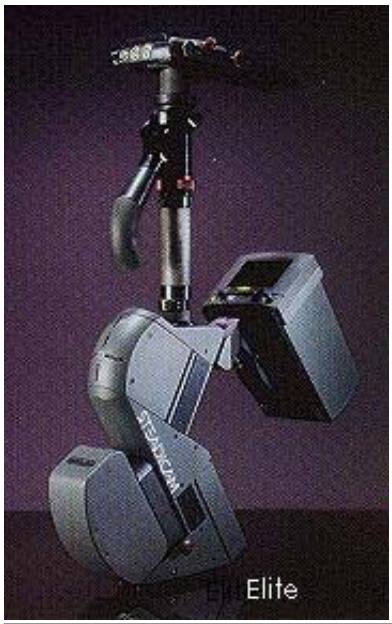


Figure 6 Cinema Products Master Series

Definition

The Steadicam is a body mounted camera isolation and stabilization device. It delivers the image steadiness of a dolly shot but enables the camera to move freely in a three dimensional space.

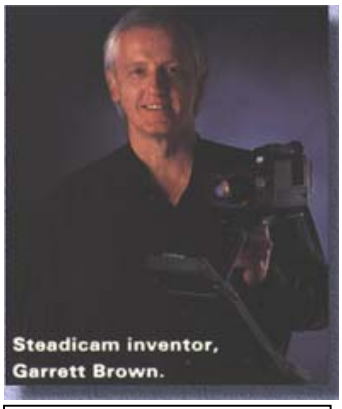


Figure 7 Garrett Brown

History

Figure 8 Garrett Brown on "Bound for Glory"

The Steadicam system has been in use since 1975 when it made its debut with inventor/operator Garrett Brown[1] on the feature film *"Bound for Glory"*. Since then it has been accepted as a standard shot-making tool on feature films around the world. It is still a specialist tool found mainly on feature film sets, although lately it has become more widely used on high budget made for TV dramas and TV series. It is widely used in music videos and big budget television commercials.

[1] Garrett Brown invented the Steadicam and is a top operator. His credits include: *Bulworth, Before and After, Casino, Philadelphia, Indiana Jones and the Temple of Doom, Return of the Jedi, The Shining*

The Steadicam won an Oscar in 1978 and an Emmy eleven years later. It has been used for some of the most famous shots in the history of film. To the world's finest producers, directors and cinematographers it has been an invaluable tool.

Background

Figure 9 Model II

The Steadicam was invented by Garrett Brown. It made it's feature film debut on "Bound for Glory". The Steadicam was originally conceived to be a stunt camera to enable smooth running shots over rough ground. The inventor, Garrett Brown quickly realized that he had underestimated the Steadicam's shot making abilities. During the first few years of development many working prototypes were developed and used in a variety of ways on films throughout America. One of the key projects that led to the development and construction of the Steadicam system that we know today was Stanley Kubrick's film "The Shining" which commenced filming in 1979.

Figure 10 WRC4 Lens Control

During this production Garrett discovered many of today's standard operating techniques. The Steadicam was hard mounted on a wheelchair via a Mitchell Mount. The 'two handed operating technique' – which is standard today was first used by Garrett on *"The Shining"*. This involves using one hand to physically place the rig in a three dimensional space and using the other hand to pan and tilt without upsetting the balance of the Steadicam. A docking bracket was constructed, focus and iris adjustments were made

with Cinema Products prototype 3-channel wireless servo-lens-control. These advances and techniques resulted in a film that still looks good today, but more importantly presented shots that had never been seen before by cinema audiences. *"The Shining"* did much to promote the Steadicam as a viable and exciting shot-making tool.

Figure 11 Larry McConkey

The most recognized Steadicam shots are running shots over uneven surfaces and up stairs. Although these now make up a very small percentage of Steadicam shots, with operators now concentrating on subtle three-dimensional moves that would be difficult or even impossible to pull off with traditional movie making equipment.

'One shot wonders'[2] are another area where the Steadicam excels with operators like Larry McConkey[3] breaking barriers with his work on such films as *"Goodfellas"* and *"Bonfire of the Vanities"*.

Basically the Steadicam is a tracking tool that is able to replace the traditional dolly in a lot of circumstances. It is also able to get shots that were impossible for Directors to realize previously.

Figure 12 Ted Churchill SteadiCamp T-shirt

[2] "One shot wonders" is a term used to describe a scene that is covered without any cuts – by a single Steadicam take.

[3] Larry McConkey, Regarded by many as the best Steadicam Operator in the world. His Credits include: *Snake Eyes, Destination Anywhere, Ransom, Sleepers, Faithful, The Age of Innocence, Sliver, Free Willy, Sleepless in Seattle, Carlito's Way, Fearless, The Good Son, Company Business, Bonfire of the Vanities, The Boy Who Could Fly, Birdy, Showgirls, Mission Impossible, Nobody's Fool*

Steadicam Configuration

The Steadicam can be set up and operated in many different ways. The most common of which being Standard or High Mode. This is where the camera is mounted on top of the Steadicam at eye height. Low mode is where the camera is mounted upside down on the sled by means of a low mode cage or a low mode bracket and the Steadicam is flipped 180 degrees vertically. By using a post extension from GPI it is possible to achieve Super High Mode or Super Low Mode.

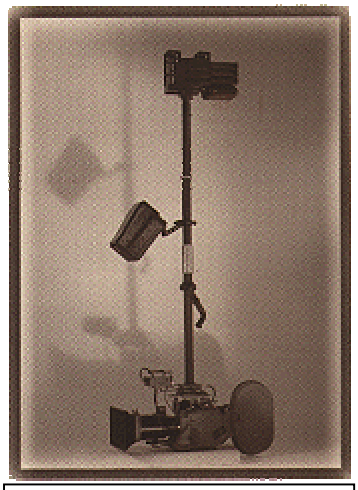


Figure 13 PRO Super Post

Figure 14 Low Mode MoveCam SL on PRO in Cage

Steadicam can also be mounted in vehicles in a variety of ways. Soft mount – where the operator wears the vest in the vehicle, or hard mount where the arm is attached directly to the vehicle via a Garfield Mount.

There are also a variety of custom mounts that are achievable to overcome a variety of problems. Once a Steadicam Operator is comfortable with their system and knows the physics required to make the Steadicam work they are able to experiment with different configurations and non standard Steadicam set ups.

How it works

The Steadicam works in these ways.

1. Angular isolation. It isolates the camera from the operator so that the operator's motions aren't transmitted.

2. It increases the camera's inertia and spreads the mass.

3. It moves the center of gravity outside of the camera to a position where the operator can manipulate it directly.

4. Spacial isolation. The articulated arm allows the operator to carry the additional weight.

5. Viewfinding. A monitor allows remote viewing of the camera's image without disrupting the angular isolation.

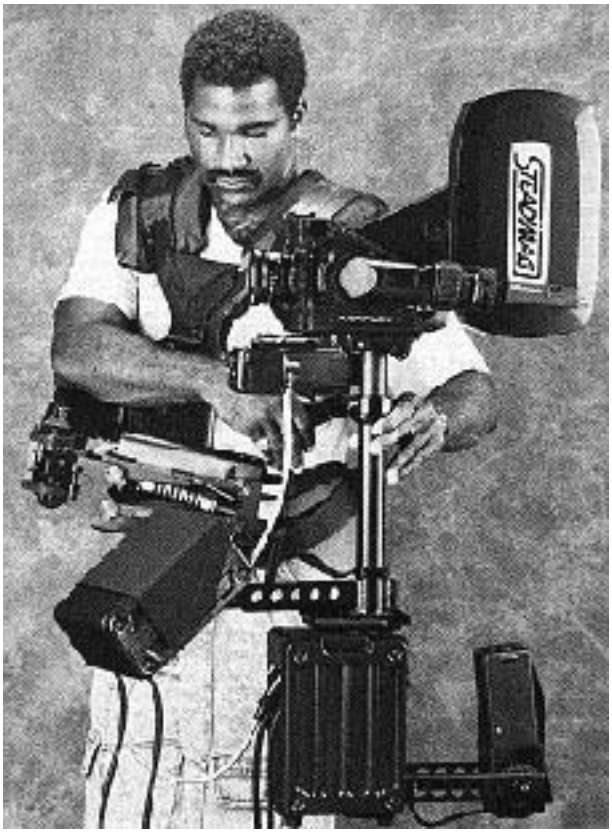


Figure 15 Arri III on IIIA

Isolation of the Camera

Figure 16 Peter McCaffrey PRO Operator on *"Hercules"*

Hand held shots suffer from one major problem - they look like hand held shots. This is because it is impossible for an operator to remove the shocks and bounces that are produced with each footstep. The human eye removes a lot of this bounce so that we see a smooth ride when walking - but this does not happen when we watch a movie on the big screen.

The Steadicam is designed to isolate two elements

1. Spacial positioning of the camera in a jerky fashion.

2. Rotation of the camera involving: tilt, pan and roll.

Figure 17 ProVid with Betacam

Isolation of the Sled and Camera

The Articulated Arm

Figure 18 Master Film Arm

Isolation is achieved with the use of an Articulated Arm. The arm is made up of a combination of springs, cables and pulleys. It is an exoskeletal type articulated support system that parallels the operators arm in any position, and almost completely counteracts the weight of the sled/camera combination with a carefully calibrated spring force (the Master Series arms are iso-elastic and thus completely counteract the camera weight while being able to hold their position in space when placed and released).

The arm absorbs the up and down movements of the operator - eliminating them before they are translated to the sled. The articulated arm under the weight of the camera/sled combination averages out these vertical shocks that are caused by each footstep. Since each upward shock is matched by a downward shock the arm averages out these shocks and this averaging effectively nullifies the bounce of each footstep isolating the camera from the operator's footsteps.

The key to this isolation is the combined mass of the camera/sled package. The larger the mass - the more resistant the camera/sled combination is to movement, the more resistant the combination, the easier it is for the arm to average out larger shocks.

The mass of the sled/camera combination also resists side to side and front to back whole camera movement - although this side to side motion is minimal when walking and can be easily reduced by the operator. The hinges at the joints in the articulated arm

are all that are needed to completely eliminate and isolate the camera from the small side to side movements of walking.

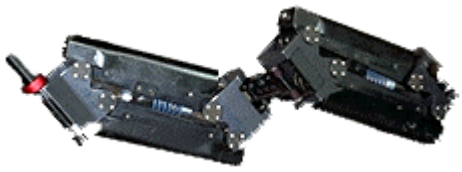


Figure 19 IIIA Arm

The arm is made up of two parallelograms connected to each other with free moving joints. Within each parallelogram there are two ‘bones’. Running along each bone there is a length adjustable titanium spring, there is a third spring running diagonally connecting the two bones at the corner positions.

The springs running along the bones are length adjustable. This tension adjustment allows the operator to adjust the weight capacity of the arm with approximately 15 pounds of range. A cable runs in an 'S' configuration throughout each parallelogram. This distributes the weight and lifting characteristics.

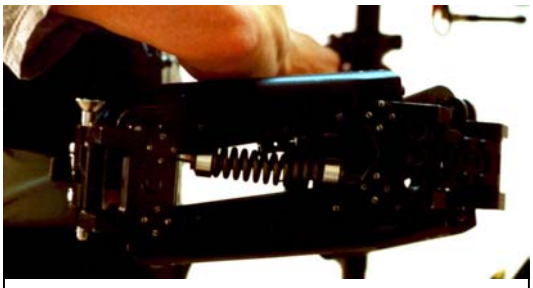


Figure 20 IIIA Arm Base Spring

With the two parallelograms connected by pivoting joints there is a total of six titanium springs, two sets of cables and several rollers. The double-jointed arm maximizes maneuverability by featuring an articulated elbow hinge, which frees the arm to move 360 degrees horizontally from the elbow. At the vest end is a socket block, which enables the operator to adjust the directional pull of the sled. The arm can also be mounted either on the right or left side of the vest. At the camera end there is a post, which slides into the gimble handle.

Figure 21 IIIA Arm Top Spring

Spreading the Camera's Mass

Figure 22 Arri BL4 on Master Series

Camera rotation off horizontal is the prime reason for unstable images. This is much more so than whole camera movement. It takes a lot less energy to tilt, pan or roll the camera than to displace the entire rig, yet a small change in camera angle has a far greater effect than a big change in camera position.

The Steadicam counters this rotational instability by increasing the camera's moment of inertia. A camera that is more inert is less prone to rotation.

On a Steadicam the camera is mounted on one end of a post with the monitor and batteries being mounted at the other. This has increased the moment of inertia. Now the weight of the camera, monitor and battery are located a greater distance from the point at which the rig rotates - the gimble. The added distance and weight means that the camera moves much faster when rotated at the gimble. Since the camera moves faster at the post than it would if it were mounted at the gimble, it takes more effort to move the camera.

How you control it

With a frictionless gimble the operator can manipulate the rig and place the Steadicam in space without upsetting the isolation. The biggest operating secret being that the Steadicam Operator’s job is not to remove instability (the rig does this for you), but to shoot without adding any additional instability.

Figure 23 PRO Gimbal

Center of Gravity

This is the point at which an object is in balance in all directions, and from which an object can be manipulated without adding any additional motion. The Steadicam works by bringing the camera's center of gravity, or center of mass from somewhere inside the camera to outside the camera and placing it where the operator can manipulate it.

Center of Mass

The center of mass (which differs to the center of gravity – theoretically, although not in actual practice) is the point at which an object is in balance in all three dimensions, and this is what the gimble is used for, it precisely intersects the three axis and lets the operator control the camera from it's center of gravity.

Conclusion.

This is the beauty of the Steadicam system. It is very simple. It achieves its results by using mass, balance and inertia.

Figure 24 Ross Judd PRO Operator

What Steadicam is Good At[4]

Steadicam is good at moving camera shots in tight quarters. Particularly for complex moves such as: guy passes camera in hallway, the Steadicam backs up, booms up rapidly, arcs into unseen doorway, pans, arcs back out into hall, booms down, tracks along, stops...yet it feels like we watched a guy pass by.

Figure 25 Arri BL3 on PRO on "Hercules: The Legendary Journeys" Operator Peter McCaffrey

Shots over rough ground, particularly where one needs to look straight ahead or behind.

Where one needs to continue on beyond the practical distance that can be accommodated with track.

Where one wishes a shot to cross a threshold, or continue up some steps, where a cut would otherwise be necessary.

Where any other technique for moving the camera would be impractical for external reasons, such as the load bearing abilities of the floor or the rigidity of a dock or bridge etc.

For any moving camera shot where the quality of the move contributes to the emotional qualities of the scene, such as the "hardness" of the accelerations/decelerations, pans, etc, and the momentary control over the balanced/unbalanced nature of the composition as actors enter or are let out of the frame.

[4] Based on IIIA Manual, Garrett Brown, 1988

Where one needs to isolate the camera from the movement of the vehicle (virtually any vehicle) for any reason, for instance:

1. Where we wish to perceive the onscreen vehicles motion within our frame.

Figure 26 Geoff Mart Steadicam Operator Arri III on IIIA

2. Where we wish to negate the movement of our offscreen vehicle so it doesn't effect our shot of some other subject.

3. Where we wish to simulate vehicle motion within a set that doesn't move (such as the work in the airplane set in "Twilight Zone").

4. Where we wish to enhance the effect of a zoom lens, by moving towards or away from a subject (while zooming slightly).

5. For human or animal (or alien) points of view, that move through the world realistically, but don't shake unrealistically.

6. Quick static shots with simple set ups where time is a factor - such as during a sunset, or in the middle of a series of Steadicam shots, where changing cameras and bringing in a dolly would be an unnecessary waste of effort.

7. Where unpredictable events preclude marks - like shooting animals, children and non-actors.

8. For various extreme technical shot requirements, such as certain kinds of optical plates, or shots that need to pan around diverse axes, such as five feet behind the lens, or three feet in front, or right on the nodal point of the lens. Such as the optical plates used in *"Star Wars: Return of the Jedi"*.

What Steadicam is not good at:

1. Static shots of long focal lengths. (It is possible, but no easy task, for a Steadicam operator to hold an entirely still frame out to about 100mm. In fact this only makes sense if it is at the beginning or end of a Steadicam move).

2. Ultra-violent actions with running etc. (why risk falling or crashing with an expensive rig and camera? This kind of thing is perfect for 'shakey-cams' and 'pogo-cams' that don't have to be rock steady, and that mostly don't need video viewfinding.

3. Quick pans with instantaneous lock offs. This is one of the hardest actions to perform with a Steadicam. Rapid tilts are even more difficult. Tilting is the most inert axis of Steadicam.

4. For mounting/carrying on things that regularly crash: skis, skates, horses, helicopters, vehicles in violent motion. Steadicam hard mounts should be subjected to no more than one-foot bumps, while soft mounted the rig can absorb approximately two-foot bumps.

Figure 27 Garrett Brown Bicycle Soft Mount

5. Or for any shots which can be easily and perfectly executed on the dolly. Why carry it if it can ride just as well!

Examples of Good Steadicam in Feature Films

"The Shining"	Steadicam Operator: Garrett Brown
"Carlitos Way"	Steadicam Operator: Larry McConkey
"Scream"	Steadicam Operators: Dan Kneece[5], Kirk Gardner[6], Mark Van Loon[7]
"Goodfellas"	Steadicam Operator: Larry McConkey
"The Mighty Quinn"	Steadicam Operator: James Muro[8]
"The Peacemaker"	Steadicam Operator: Guy Bee[9]

[5] Dan Kneece: Top Steadicam Operator whose Credits include: *Bullworth, Jackie Brown, Spawn, Lost Highway, Scream, Eraser, Crimson Tide, The Last Supper, The Vanishing, Twin Peaks: Fire Walk With Me, People under the Stairs,*

[6] Kirk R. Gardner: Top Steadicam Operator whose Credits include: *Selena, Metro, Scream, Bulletproof, A Thin Line Between Love and Hate, Girl 6, Vampire in Brooklyn, Waiting to Exhale, Dead Man, Corrina, Corrina, House Party 3, Jimmy Hollywood, Nightmare on Elm Street 7, Loaded Weapon 1, 3 Ninjas, Candyman, Boiling Point, Demolition Man, Double Dragon, Posse*,

[7]Mark Van Loon: Steadicam Operator Whose Credits include: *Deep End of the Ocean, Scream, Broken Arrow, Heavyweights, Lost in Yonkers, Batman 3, Blue Chips, The Firm*,

[8] James Muro: Top Steadicam Operator Whose Credits include: *Titanic, L.A. Confidential, Heat, Strange Days, How to Make an American Quilt, Clueless, True Lies, Heaven and Earth, Falling Down, A Few Good Men, Sneakers, White Sands, Point Break, Terminator 2: Judgement Day, The Doors, JFK, Predator 2, Dances with Wolves, The Abyss, Field of Dreams, The Mighty Quinn*,

[9] Guy Bee: Top Steadicam Operator whose Credits include: *The Replacement Killers, The Peacemaker, ER, Waynes World 2, Jason's Lyric,*

Balance

Figure 28 Balancing an Arri SRII on IIIA

The key to operating a Steadicam successfully is being able to balance the rig successfully so that the operator is not fighting the laws of physics while shooting. The Steadicam works by being in balance, and there are two types of balance that the Steadicam operator needs to consider. Static balance, and dynamic balance.

Static Balance

Static balance involves getting the rig to hang at a specific angle (more or less upright and usually level on the horizon). It also involves the vertical positioning of the gimble relative to the center of gravity of the rig, which effects the pendular action of the rig under acceleration and how much force is required to tilt the camera. Within some limits static balance is a factor of individual operator preference.

More 'bottom heaviness' gives more 'feedback' and strongly seeks vertical when the Steadicam is not accelerating. A lot of bottom heaviness creates problems when moving the camera, especially when shooting from vehicles (where one can accelerate strongly and/or over long time periods), and when tilting. This pendular motion is hard to correct while operating a too heavy rig.

Less bottom heaviness makes for easier tilts and fewer problems when moving the camera, but the reduction in feedback may leave the operator comfortably off level. More experienced operators tend to run the rig in this way.

Correct bottom heaviness is really a matter of "does it work for you?" Experiment to discover if your current choice actually works best for you. A good starting point is a rig that tilts from horizontal through to vertical in approximately two to two and a half seconds.

Trim is a matter of balancing the rig so it seeks a particular tilt (maintaining headroom, holding a window in frame etc). Allowing the balance of the rig to hold the frame increases the isolation from the operator and therefore increases the steadiness of the shot. With older Steadicam models, operators were forced to set the trim for one part of the shot and struggle through the rest of it. Even in the model IIIA, the fore-aft trim was difficult to use and apt to slip.

The adjustable camera mounting platform, or Donkey Box made trimming much easier and more secure. It put both the fore-aft and side-side trims on acme screw threads. It was a big step in the right direction, but still left operators trimming for only one part of the shot.

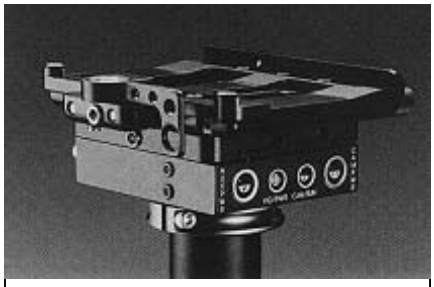


Figure 29 Donkey Box

Figure 30 Master Film RF Gimbal

Incorporated into the Master Series is the ability to continuously adjust the fore-aft and side-side trim via remote controlled motors. The operator or the assistant can change the trim to suit each part of the shot (or adjust for the weight shift of co-axial film magazines). Staying in proper trim can dramatically affect one's operating ability.

Dynamic Balance

The Steadicam is in dynamic balance when the center post remains vertical as the unit is panned. For each combination of camera, monitor height, post length, accessories etc, there are many possibilities for statically balancing the Steadicam. There is only one combination that balances the rig dynamically. This combination can be found by three different methods. Via a formula, via a computer program that uses the formula, or by trial and error.

The non-mathematical approach is based on the same principle as the theory but it is done with the unit in a trial and error fashion.

First balance the rig statically, placing the monitor where it is desired. Clamp the gimble to a stand that allows the rig to swing through 360 degrees.

Spin the center post. Do this carefully since your hand may introduce extraneous motions. A good way to do this is to start the unit rotating slowly and then build up the speed by additional twists. Observe the bottom of the post.

If the system is not dynamically balanced the bottom of the post will start moving in a small circle. If the battery is to the outside of the circle the battery is too far from the post. Move the battery closer to the post and rebalance by moving the camera away.

This condition can also be corrected by moving the monitor away from the post and rebalancing with the camera or by lowering the monitor.

If the monitor is to the outside of the circle the battery is too close to the post. Move the battery away and rebalance with the camera. This condition can also be corrected by moving the monitor closer to the post and rebalancing with the camera or by raising the monitor.

A third condition can occur. Both battery and monitor are seen as tangential to the circle. This happens when the three masses are not in the same plane with the axis. In

order to balance a three mass system you must have all masses in a common plane with the axis. To correct this, move either the battery or the monitor toward the circle.

The higher the monitor, the closer the battery c.g. gets to the center post, and the more the camera c.g. moves away from the post to the rear. The heavier the camera, the closer its c.g. will be to the center post.

Another aspect of balance (both static and dynamic) involves post length and, in the case of the Master Series and some modified Steadicams, the extension of the battery and the monitor from the center post. Extending the post will slow down the rig's angular response in tilt and yaw, while extending the battery and monitor will slow down the rig's angular response in tilt and yaw, while extending the battery and monitor will slow down the rig's response in tilt and pan. Reducing the length of the post or bringing in the battery and monitor will make the rig rotate more quickly on the same axes.

Once you have achieved dynamic balance, you may move the gimbal anywhere along the post. Dynamic balance will not be affected.

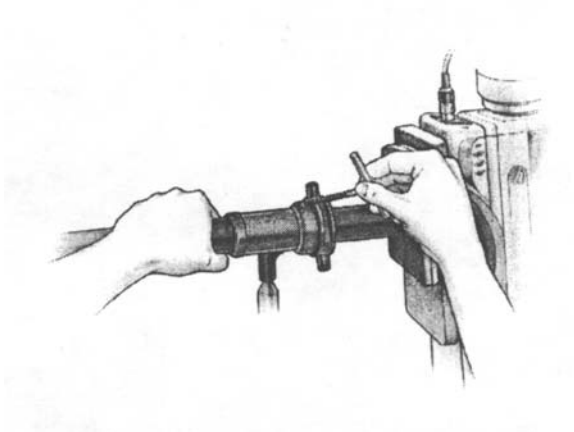


Fig. K: Adjusting the gimbal locking bolt with the center post horizontal

Figure 31 Gimbal adjustment with the rig at horizontal

Steadicam Arms

There are five basic types of arms. Cinema Products make four of these, the fifth is made by George Paddock Inc.

In all models the arm serves as a tool to counter the weight of the Steadicam rig/camera and distribute it to the vest. The arm also eliminates the shock transmitted by the operators' footsteps and makes it possible for the operator to manipulate the rig. The Steadicam is as much a way of holding a camera as it is a stabilizer.

Figure 32 Model II Arm

The model I or II arm has a single hinge and only a small weight adjustment. The Model III and EFP arms have a double hinge, are easily flipped to right or left side operation, and have a large weight adjustment. Some arms even have modifications to strengthen the U-shaped end pieces.

The Steadicam SK has a very different arm. It is only useful for lightweight video cameras.

The Master Series arm has a wide weight carrying capacity and a more iso-elastic feel.

The PRO arm is totally modular and is able to cover all camera/sled weights with the one field adjustable unit.

Figure 33 SK Arm

Model 1 or 2 Non-adjustable Arms	
Spring Color	Median Load (+/- 21/2 lbs.)
Red	37
Green	40
Blue	54
Black	51
Gold	54

Adjustable Arms	Weight Capacity (lbs.)
IIIA Standard	37 – 57
IIIA Lightweight	29 – 47
EFP	24 – 39
Master Series Film	20 – 45
Master Series Elite	20 – 45
Master Series EDTV	20 – 45
Master Series Broadcast	18 – 35
Master Series Pro-Vid	15 – 26
Master Series Video SK	09 – 19
PRO Arm	13 – 72

PRO Arm

The PRO arm was released in July 1997 and takes a different approach than that of Cinema Products. The PRO arm is modular, this is in keeping with the rest of the PRO system and the PRO philosophy, which dictates that every part of the PRO, is flexible, modular, and field replaceable. The Arm uses sealed Spring Canisters which allow for different springs (and thus different tensions) to be changed by the operator in the field.

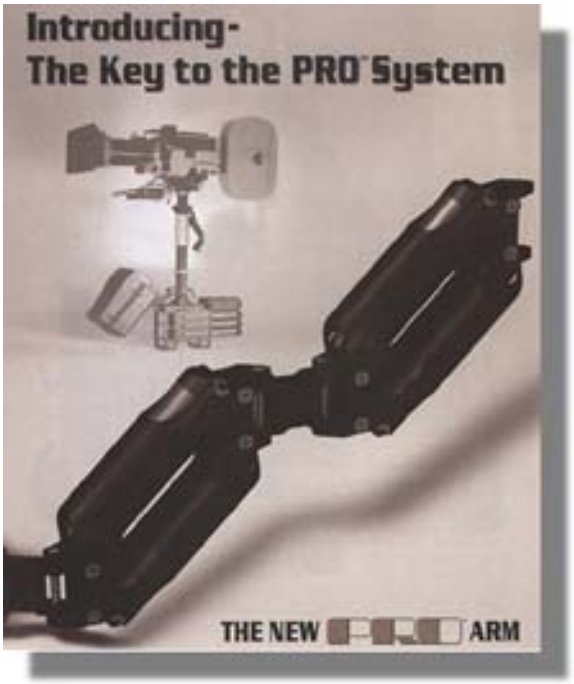


Figure 34 Pro Advertisement

GPI recently introduced their arm to very positive reviews. The new arm design eliminates the pulleys and cables normally found in the higher end arms. The benefit of this design is the reduction of friction in the arm's range of movement. This gives the arm a smoother and easier movement up & down it's range and reduces fatigue on the operator. Although the arm will not stay where put, like the Master arm, it is much easier to keep in the desired position.

David Emmerichs[10] Views on the PRO Arm[11]

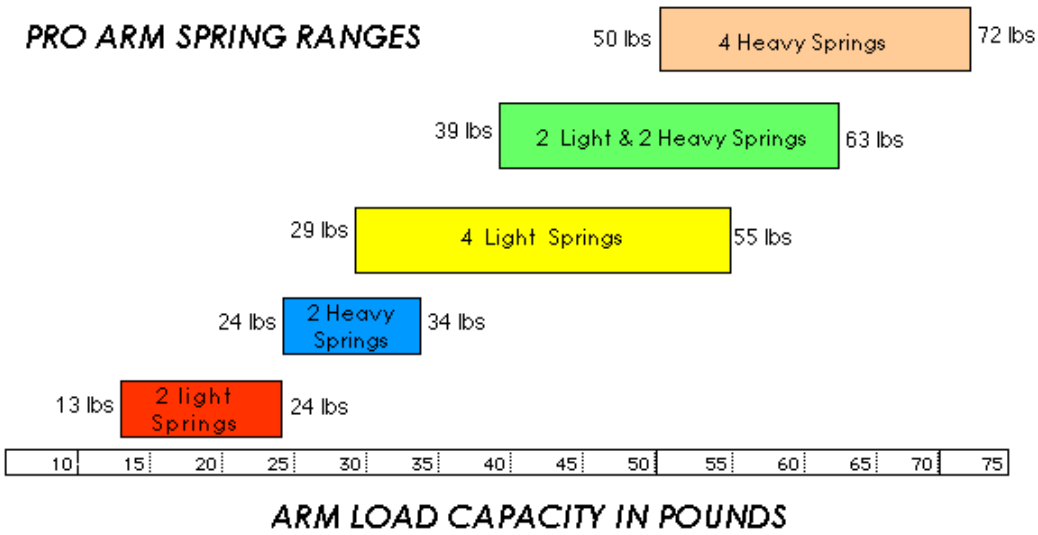
Like all the products George has come out with it is simple in concept, graceful in execution, and very user friendly. The arm is not iso elastic yet it doesn't require a lot of effort to boom up and down. Like the steering wheel in your car it will seek it's optimum float point which will feel very familiar to users of the Model III Arm. However, as Andrew mentioned earlier it takes very little force to lift the arm or to boom it down, somewhere in the neighborhood of 2 1/2 lbs. There is also far less friction than in the previous arm.

Visually the configuration is similar to the other arms in that there are two lifting parallelograms connected by a double hinged elbow. There the similarities end. There are no cables or pulleys in the arm. The work is done by up to four compression springs in easily removable canisters. The springs come in two strengths: light and heavy. They can be combined in various ways to lift anywhere from 13 to, heaven help us, 72 pounds. The lightest weight setting is achieved by only using one spring canister in each arm section. Using a spring combination of two heavy's and two lights will give you a lifting range of 39 to 63 pounds, a good range for our everyday use.

Figure 35 PRO Arm

I mustn't forget to mention that each canister is individually adjustable using a good old gimbal wrench. If you are skeptical about the ease of changing springs around wait until you hear this. All four springs can be replaced in about two minutes, and that's without rushing. It's faster to lose the two light springs and operate a lightweight rig (PRO Lite with a Robings 2C for instance), using just the two heavy springs, than it is to crank down the weight of each individual spring.

[10] David Emmerichs is a top Steadicam Operator. His current features include: *Con Air, Alien: Resurrection, The Fan, Nixon, Seven, On Deadly Ground, Menace II Society*
[11] Excerpt from AOL Steadicam Newsgroup, 1997



Removing two spring canisters takes less than 30 seconds.

Great, it looks cool, comes apart easily for maintenance and is very sturdy, but does it work? After trying it for the first time I was thrilled. It's unbelievably smooth, easy to operate and seems to have no bad habits. The arm won't lock up at either end and it's built so soundly that there is very little flex from the torque the rig is applying to it. It's hard to describe but this seems to make the rig feel lighter. After playing with it for a while it feels perfectly natural. I was completely unprepared for how it would feel to go back to my old arm. I wanted to weep. My only problem with the new PRO arm is that I haven't got it yet.

Arm Conclusion

With the exception of the SK and Master Series, arms work best at or near the top of their weight ratings, with the springs fully stretched. Adjustable arms have a much harsher feel at the bottom of their weight range than a non-adjustable arm. Non adjustable arms can be modified for adjustable springs, and/or double hinged, and/or equipped for easy right side/left side changes. There are a lot of partially modified arms in use today. Rods or braces have strengthened some across the U-shaped end pieces.

The Master Series Arm

The Iso Elastic arm provides even lift throughout a larger range of lifting strength and position. Hand-adjustable lifting power is available on the fly. One adjusting knob per arm segment permits fine tuning the exact float point and the precise interaction of each arm segment in seconds while standing or walking with the camera floating. The arm is lighter, more rigid and with less friction than the older models. It is constructed out of aluminum, titanium and carbon fiber.

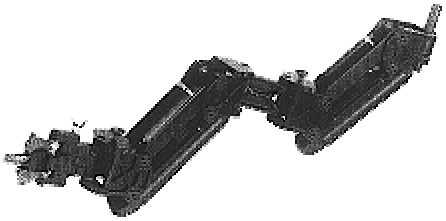


Figure 36 Master Series Arm

Garrett Browns comments on the new Master Series Iso-elastic Arm[12]

Figure 37 Garrett Brown with Student

Contrary to myth, the new arm weighs less than a pound more than the original arm, and the width, measured at the trunnions is within a millimeter. As you know, the strength is instantly adjustable by hand while the arm is floating. I usually tweak the lifting range of the arm (about two vertical feet), so it is centered on the average lens height (if constant), or I bracket the range of desirable lens heights for shots that boom up or down. Previously we used to employ a large variation in mounting post lengths, since the arm floated strongly at mid position. It was better to lift it to boom up, even though it required lots of force, than to crank up the old arm to gain height and then have to push down strongly to get lower (which just increases the strain on your back). In any event adjusting the arm was

[12] Posted on AOL Steadicam Newsgroup, 1997

a clumsy and time-consuming event. Now you can use the very top of the arm range for your high position and hold it effortlessly, even if the nominal 'float' point is down near the bottom. And you can tweak the float point up or down as an afterthought even as the slate is going in. I find that overall fatigue is reduced and precision is improved. The only difference is that both arm sections should be properly tuned together so that the 'upper arm' closely follows the rise and fall of the 'forearm'. Also, since the arm is much more neutral as to height, your right hand must retake responsibility for consistent lens height, rather than just relying on the old float point.

Arm Maintenance

Keep the arm clean and dry. There are many steel parts in the arm that can rust. If the arm has a harsh or noisy feel to it, it may be time to clean and re-lubricate the trunnions and some other surfaces and bearings. Use good quality grease. If the adjustment screws seem to bind, have the factory replace them. Avoid changing springs and cables yourself; these have been calibrated and adjusted at the factory.

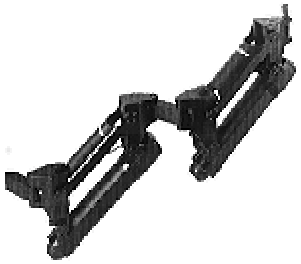


Figure 38 ProVid Arm

Safety Precautions

1. Keep fingers out of the arm bones.
2. Check all hinge pins (some styles can shift when not under load; all can crack).
3. Avoid bottoming out on bumps (cannot take the shock).
4. Make 'side to side' adjustments with only one of the two aircraft screws.
5. Check and correct alignment of steel cables to the center springs (they often twist around).

Spring Tension

Adjustable arms.

Figure 39 IIIA with Betacam

Adjusting the spring tension in the arm affects the weight lifting capacity of the arm. These adjustments are made to match the lifting capacity to the weight of the particular camera, sled, and accessories. Each section of the arm should hang slightly lower than horizontal. To adjust the tension loosen or tighten the pairs of long Allen screws on the end of each arm section to properly tension the springs. Both screws in each section should be adjusted equally for best results. The collars on the end of the springs in each section of the arm should come to the same positions in the windows in the arm covers. The adjustment screws in one section should be adjusted to approximately the same marks as the other section of the arm. If you add or subtract weight you will have to tighten or loosen the spring tension in the arm to compensate.

Master Series Arm

The spring tension is adjusted by turning two knobs. They are located on the top section of each parallelogram. No tools are required and the adjustments can be made while the arm is under load.

Figure 40 Spring Adjustment knob Master Series

PRO Arm

Due to its modular nature the spring tension is adjustable in three ways. You can add and remove spring canisters of different weights. You can also adjust the spring tension within these canisters with a gimble wrench. Ideal spring tension can also be achieved by a combination of these two techniques.

Angle of Lift

This set of adjustments is particular to each operator and is independent of the weight of the camera/rig. Your physique and posture effect the angle of the socket block on your body and, consequently, the angle that the arm will lift the Steadicam.

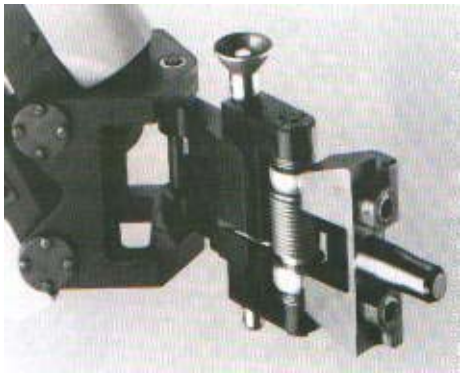


Figure 41 Socket Block

The angle of lift of the arm is adjusted via two pairs of screws set at right angles to each other. The pairs of screws in the arm ("rod ends", or "aircraft screws"), control the angle of lift of the arm side to side. The pair of screws in the socket block ("T-head thumb screws") control the angle of lift fore and aft. The correct combination of their adjustment and the operator's stance will cause the arm to effectively lift straight up.

Older Model Arms

Model 1 arms were non-adjustable and had a very light weight capacity – somewhere around 39 lbs. They are impractical to upgrade as just about everything except the main supports would need to be replaced. There are very few of these arms around and they are considered to be a dead end arm.

Model 2 arms are essentially the same as a Model 3 arm with the main differences being the lack of an articulated elbow and the materials used. Model 2's have a hinge system joining the two sections whereas Model 3's have an articulated elbow. This allows for easy switching between left and right-sided operation without having to flip the hinge from one side to the other. This is used primarily where the operators body position would impede the camera position. The articulated arm is better from a weight distribution point of view as well, with the weight placed over the center of the arm and not favoring one side.

Model 2's didn't have the quick release aircraft pin that pulls out and allows the operator to switch sides. This section which attaches to the vest and then to the shoulder was of one-piece construction. Early Model 3 arms are tow pieces and have the aircraft pin. They can be identified by a "window" in the part that attaches to the shoulder via a stud. This window was eliminated in later designs to reduce flexing while under load. In addition later model 3 arms can be spotted by four small rubber bumpers replacing a single larger bumper on the shoulder section of the arm.

Model 2 arms have pulleys that look like a single pulley with two slots for each cable whereas a Model 3 arm has two pulleys together on the same stud. This doesn't effect anything but can be used as an identifying feature.

Model 2 arms can be upgraded with an articulated elbow. This upgrade can be spotted because the "dogbones" or the main support braces are not anodized. The Model 3's are anodized and are all black.

Once an adjustable model 2 arm has been upgraded there is virtually no difference between it and a Model 3 arm. However there is a difference between early modified Model 2 and early Model 3 arms and the later ones.

1,2's and the first Model 3 arms used cast aluminum wrist, shoulder and elbows (with delrin inserts). These cast pieces are more susceptible to breaking under load, especially with heavier cameras. The later arms used aircraft quality machined versions of these parts. The machined parts are less susceptible to twisting under load and are therefore

stronger. The machined versions can be spotted because they have holes drilled into each of the pieces.

Another upgrade on the 3 arm is the use of a stud that connects the trunions. This helps reduce the chance of the arm components flexing under load. The old wire rod stop mechanism that prevents the adjacent “dogbones” from touching while not under load was replaced with delrin stops.

Arm upgrades are a very personal option and therefore there are many arms that have had some upgrades performed, and not others.

Figure 42 PRO with Lightweight II

Steadicam Arm Upgrade Path

Model 2 Arm	Early Model 3 Arm	Latest Model 3 Arm
-Hinge elbow and cast parts -Non anodized "dogbones" -4 point trunions -Adjustable with black or gold springs -Stud instead of aircraft pin/window	**-Articulated elbow** **-Cast aluminum parts** **-Solid disk trunions** **-Aircraft pin with window**	**-Aircraft aluminum machined parts** **-Dust covers on bearings** **-Stud connecting trunions** **-Solid trunions** **-delrin stops** **-Aircraft pin/no window**
Upgrade Path to Late 3	**Upgrade Path to Late 3**	**Upgrade from EFP to 3**
-Articulated elbow **-Aircraft aluminum machined parts** **-Dust covers on bearings** **-Solid trunions** **-Trunion studs** **-delrin stops** **-Aircraft pin/no window**	**-Aircraft aluminum machined parts** **-Dust covers on bearings** **-Stud connecting trunions** **-delrin stops** **-Aircraft pin/no window**	**-Increase spring capacity**

Different Steadicam Models[13]

General

All models of the Steadicam (and the PRO sled) can make great shots. The models vary by age and design features, and this short list gives a brief overview of their differences. More detail on the various arms is in the main body of the course outline.

Model I

If you can find one, it might be a cheap way to get started. It's likely to be old and abused, the gimbal trashed, and very difficult to get into low mode. The monitor is a bit small as well. If it's a great price, in great shape, and you're into making mod's, it can be a very serviceable rig.

Figure 43 Model 1

Model II

Similar to the Model I. You may find a highly modified Two that works pretty well, or one in great shape. Not dynamically balanced (or able to be balanced) without some sort of modification. The monitor is separate from the sled, making it easier to modify than Model I.

Figure 44 Model 2

[13] From Steadicam Workshop Handout, Malibu Classic, 1997

EFP

New ones with a green screen monitor are a reasonable value compared to the full-featured and full-priced III's and Master Series Steadicam's. They work well with video, 16mm, and very light 35mm MOS cameras. The arm, vest, gimbal, etc. will not support the larger cameras - a hassle just when the big job comes your way. However, it doesn't need much modification to do its job really well.

Figure 45 EFP

Model III and IIIA

The workhorse of the industry, and probably the best-used value now that the PRO rig and the Master Series Steadicam are established. The III needs at least a side-to-side plate for the camera mounting stage for balancing; both the III and lIIA benefit from the Donkey Box. Both lack a provision for 24 volts and the screens are small compared to the Master Series and the PRO.

Figure 46 IIIA

Master Series

For the moment, this is the top-of-the-line, with the biggest, sharpest monitor and the most bells and whistles to make operating easier. A beefier battery than the III's and 24 volts by an efficient converter system. The arm is a joy as well, and the price is reasonable for what you get. This is probably not the best machine for a beginning operator to buy from a cost (benefit perspective: a used IIIA would do much the same work for a lot less dough. The Master Series is also the newest, most radically redesigned Steadicam on the block, but it's reliability isn't proven – or disproven - yet.

Figure 47 Master Film

PRO (Paddock Radical Options) sled

A bigger monitor and a beefier gimbal than the III's, plus integral 24 volts (via batteries) and topped with a Donkey box. It's expensive and it's a couple of pounds lighter than the Master Series as well. The three-battery system may be a hassle; and there have been reports that the monitor isn't very sharp and that some parts aren't holding up under fire. But be sure that the jury is still out and divided on this one and will be for a long time to come.

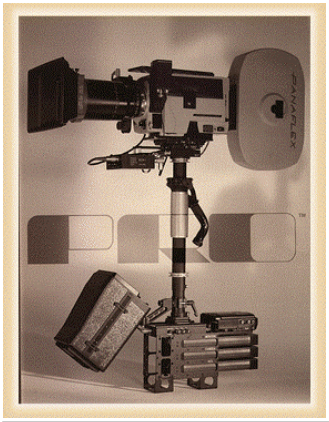


Figure 48 PRO

SK

The stripped-down, lightweight, and inexpensive no-frills model works well in its own environment. Dynamically balanced, but with the monitor too low to be useful. Useful for rocking and rolling. The vest is very light and the arm travel is limited. A wise choice for someone who knows his market.

Figure 49 SK

JR and DV

Figure 50 DV

Great for handycams, especially the lighter ones. Great for home movies and documentaries on Hi-8. Good for practicing, broad rehearsals of shot. Fun to have on the set. Can now be had at a reasonable price through dealers. Dynamically balanced.

Figure 51 JR

The Different Steadicam Models made by Cinema Products

Steadicam Models	Master Film	Master Elite	Master EDTV	Master Broadcast	EFP	ProVid	SK
Minimum Camera Weight	20lb 9.1kg	20lb 9.1kg	20lb 9.1kg	18lb 8.2kg	15lb 6.8kg	15lb 6.8kg	8lb 3.6kg
Maximum Camera Weight	45lb 20.4kg	45lb 20.4kg	45lb 20.4kg	35lb 15.9kg	30lb 13.6kg	26lb 11.8kg	19lb 8.6kg
Monitor Size Diagonal	5" 13cm	4" 10cm	5" 13cm	4" 10cm	4" 10cm	4" 10cm	3.5" 8.9cm
Monitor Ratio	16:9 4:3	16:9 4:3	16:9 4:3	4:3	4:3	4:3	4:3
Power Consumption	30W	20W	30W	20W	12W	20W	18W
Battery Capacity	5Ah	5Ah	5Ah	5Ah	5Ah	5Ah	2.5Ah
24V Converter	Yes	Add $1850	No	No	No	No	No
Motorized Camera Stage	Yes	No	Add $3000	No	No	No	No
Arm Type	Iso-Elastic TM	Iso-Elastic TM	Iso-Elastic TM	Iso-Elastic TM	Parallel-ogram	Iso-Elastic TM	Iso-Elastic TM
Arm Travel	30" dual action	30" dual action	30" dual action	30" dual action	30" dual action	28" dual action	17" single action
Number Of Springs	6	6	6	6	6	2	1
Sled Weight	17.9lb 8.1kg	16.7lb 7.6kg	16.1lb 7.3kg	14.6lb 6.6kg	12.3lb 5.6kg	9.4lb 4.3kg	8.8lb 4.0kg
Battery Weight	6.0lb 2.7kg	4.6lb 2.1kg	4.6lb 2.1kg	4.6lb 2.1kg	4.6lb 2.1kg	4.6lb 2.1kg	2.9lb 1.3kg
Arm Weight	11.7lb 5.3kg	11.7lb 5.3kg	11.7lb 5.3kg	11.7lb 5.3kg	10.1lb 4.6kg	11.0lb 5.0kg	6.6lb 3.0kg
Vest Weight	9.4lb 4.3kg	8.8lb 4.0kg	8.8lb 4.0kg	8.8lb 4.0kg	8lb 3.6kg	5.3lb 2.4kg	5.3lb 2.4kg
Total Weight w/o Camera	45lb 20.4kg	41.8lb 19.0kg	41.2lb 18.7kg	39.7lb 18.0kg	35.0lb 15.9kg	30.3lb 13.8kg	23.6lb 10.7kg
Frameline Generator	Yes	Yes	Yes	Add $1750	Yes	Add $1750	No

Artificial Horizon Level Indicator	Yes	No	Add $7500	No	No	No	No
Triax Conn On Vest	Add $1500	Add $1500	Yes	Add $1500	No	No	No
Basic System Price US$	$52,500	$41,000	$41,500	$35,000	$29,000	$20,500	$8,000

Figure 52 PRO Lightweight II Low Mode

Figure 53 PRO

STEADICAM® MASTER FILM

The Master Film is Cinema Products flagship model for the Master Series. It is the first comprehensively redesigned Steadicam since 1982. A great deal of effort went into the visual appearance of the Master Series – occasionally at the expense of good design principals. Although this approach has worked for Cinema Products with the company selling more Steadicam's from a greater range of models than ever before. The main features of this model being:

Figure 54 Master Film with BL4

No tools adjustment of: post length, gimbal position, switch to low mode.
The monitor's viewing angle is adjusted around its center of gravity – therefore the sled doesn't need to be rebalanced.
The Iso-Elastic Arm provides even lift throughout its entire range.
The stage is motorized allowing adjustment of tilt and roll at any time during the shot via a removable RF controller mounted on the gimbal handle.
The wide screen 16:9 aspect ratio monitor is the largest available.
The battery condition is displayed on screen as well as an LED display on the battery itself.
Adjustable backlit bubble level.

MASTER FILM SPECIFICATIONS

Sled:

No-tools adjustments

Modular components for field replacement

Center of Gravity Gimbal:

Control at system center of gravity No-tools coarse/fine adjustment

Can be adjusted while fully loaded

Figure 55 Master Film

Battery Options:

Optional CP 14.4 V with onscreen charge display

Anton/Bauer or PAG

Monitor:

High intensity 5" CRT

16:9/4:3 switchable aspect ratio

Power consumption: 30 Watts

Scan rate: NTSC/PAL

Figure 56 Master Arm

Master Series Arm:

30" dual action Iso-Elastic(TM)

Even lift throughout its range.

No tools adjustment while fully loaded

Camera weight capacity: 20 - 45 lbs.

Master Series Vest:

Lightweight VideoLink

Reversible adjusting bridge

Cam-lock buckles for ultra-snug fit

Figure 57 Master Vest

MASTER ELITE SPECIFICATIONS

Sled:

No-tools adjustments

Modular components for field replacement

Center of Gravity Gimbal:

Control at system center of gravity

No-tools coarse/fine adjustment

Can be adjusted while fully loaded

Battery Options:

Optional CP 14.4 V with onscreen charge display

Anton/Bauer or PAG

Monitor:

High intensity 4" CRT

16:9/4:3 switchable aspect ratio

Power consumption: 20 Watts

Scan rate: NTSC/PAL

Master Series Arm:

30" dual action Iso-Elastic(TM)

Even lift throughout its range

No tools adjustments while fully loaded

Camera weight capacity: 20 - 45 lbs.

Master Series Vest:

Lightweight VideoLink

Reversible adjusting bridge

Cam-lock buckles for ultra-snug fit

Figure 58 Master Elite

Figure 59 Master Arm

Figure 60 Master Vest

MASTER EDTV SPECIFICATIONS

Sled:

No-tools adjustments

Modular components for field replacement

Monitor pivot maintains dynamic balance

Precision leadscrew stage drives

Center of Gravity Gimbal:

Control at system center of gravity

No-tools coarse/fine adjustment

Can be adjusted while fully loaded

Battery Options:

Optional CP 14.4V with on-screen charge display

Anton/Bauer or PAG

Monitor:

High intensity 5" Diagonal CRT

Switchable 16:9 / 4:3 aspect ratio

30 Watts power consumption

NTSC/PAL scan rate

Master Series Arm:

30" dual action Iso-Elastic(TM)

Even lift throughout its range

No tools adjustments while fully loaded

Camera weight capacity: 20 - 45 lbs.

Master Series Vest:

Optional lightweight VideoLink

Reversible adjusting bridge

Cam-lock buckles for ultra-snug fit

Figure 61 EDTV

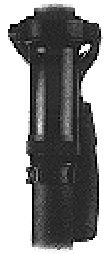


Figure 62 Gimbal

Figure 63 EDTV Triax Vest

MASTER BROADCAST SPECIFICATIONS

Sled:

No-tools adjustments

Modular components for field replacement

Monitor pivot maintains dynamic balance

Precision leadscrew stage drives

Center of Gravity Gimbal:

Control at system center of gravity

No-tools coarse/fine adjustment

Can be adjusted while fully loaded

Battery Options:

Anton/Bauer or PAG

Monitor:

High intensity 4" Diagonal CRT

4:3 aspect ratio

20 Watts power consumption

NTSC/PAL scan rate

Master Series Arm:

30" dual action Iso-Elastic(TM)

Even lift throughout its range

No tools adjustments while fully loaded

Camera weight capacity: 18 - 35 lbs.

Master Series Vest:

Optional lightweight VideoLink

Reversible adjusting bridge

Cam-lock buckles for ultra-snug fit

Figure 64 Master Broadcast with Anton Bauer Battery

Figure 65 Master Battery

EFP SPECIFICATIONS

Sled:

Designed for video and film

CP Gimbal with precision dynamics

Battery Options:

Anton/Bauer or PAG

Monitor:

4" Diagonal CRT

4:3 aspect ratio

20 Watts power consumption

NTSC/PAL scan rate

Stabilizer Arm:

30" dual action parallelogram

Camera weight capacity: 15 - 30 lbs.

Vest:

Reversible adjusting bridge

Figure 66 EFP

Figure 67 EFP Arm

PROVID SPECIFICATIONS

Sled:

Utralight composite construction

Modular components for field

replacement monitor pivot maintains dynamic balance

CP Gimbal with precision dynamics

Battery Options:

Anton/Bauer or PAG

Monitor:

High intensity 4" Diagonal CRT

4:3 aspect ratio

20 Watts power consumption

NTSC/PAL scan rate

Stabilizer Arm:

28" dual action Iso-Elastic(TM)

No tools adjustments while fully loaded

Camera weight capacity: 15 - 26 lbs.

Vest:

Reversible adjusting bridge

Figure 68 ProVid

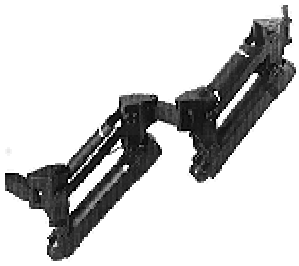


Figure 69 ProVid Arm

Figure 70 ProVid Vest

VIDEO SK SPECIFICATIONS

Sled:

Monitor pivot maintains dynamic balance

Video SK Gimbal

Battery Options:

Anton/Bauer, Dual NP-1 or PAG

Monitor:

3.5" Diagonal CRT

4:3 aspect ratio

18 Watts power consumption

NTSC/PAL scan rate

Stabilizer Arm:

27" single action Iso-Elastic(TM)

No tools adjustments while fully loaded

Camera weight capacity: 8 - 19 lbs.

Master Series Vest:

Reversible adjusting bridge

Figure 71 SK

Figure 72 SK Arm

Figure 73 SK2 Vest

Garrett Browns comments on the Master Series[14]

Jonathan[15] and I have used the Elite and the Master Series Film for 14 hours daily for two months on *"Bulworth"* with Warren Beatty[16] and Vittorio Storaro[17]. It's my first complete feature since *"Philadelphia"*, and it has been 80% Steadicam. We frequently shoot with two rigs, either on foot or side-by-side on dolly and bazooka. The 32mm Cooke is a mainstay, but we also jump to the 75mm and 100mm Cookes on almost every scene. We are having a great time working together and are really getting into the new features of the Master's (it's my lifetime best shooting experience, gearwise), and since there seems to be a lot of misinformation circulating on this subject, I am happy for a chance to comment. These rigs offer some radical new shooting opportunities and refinements, and I am more and more convinced that they facilitate some real advances in technique - as follows:

Snap Gimbal Clamp

The ability to adjust the bottom-heaviness instantly without tools is indispensable. Again we frequently tweak it as the slate goes in (which explains the sideways slates in dailies!) Although the vertical weight shift is minimal with the SL magazine, I frequently adjust bottom-heaviness again halfway through the magazine because it's so easy and fast and fumble-free.

THE VEST

I modified my vest so I could take advantage of the long exposed dovetail for adjusting the arm mounting bracket up and down and it has been a big improvement. Simply remove the outside waist strap and ratchet on the same side as the arm is mounted, and bolt the inside strap at the desired length to the edge of the plastic. Now the arm bracket can be slid all the way down without interference. Of course drill a hole for a small screw at the bottom of the dovetail so that the arm bracket can't slide right off. Now, instead of changing post lengths, or adding the f-bracket for "low hi mode" I find that the 11 inches of vertical travel I now have is almost always sufficient. My 'low hi mode'

[14] Posted on AOL Steadicam Archive March, 1997
[15] Jonathon Brown. Garrett Brown's son and Steadicam Operator. His Credits include:*Four Rooms, First Kid,*
[16] Warren Beatty, Producer, Director and star of *Bulworth*
[17] Vittorio Storaro, an Italian DP, regarded by many as the worlds best.

with the arm bracket at the bottom gets the gimbal below where I can reach it with my hand. My max lens height, with the bracket all the way up is as high as I customarily need it, and I have never had to change my mounting post length for the whole show. The new Master mounting post adjusts easily with its spiral groove system, but of course the longer the post, the more difficult it is to switch sides with the rig tilted down. This is another adjustment which is easy to make at the spur of the moment. Meanwhile I have gotten quite used to the new vest and like the option to flip back the over-centers latches to 'ease the squeeze' between shots.

ELECTRONICS:

All video in/outs are via DA's (distribution amps) so the optimum video voltage is never reduced by add-ons, and since the frame lines are synthesized and mixed in as composite video, I find that they remain perfectly crisp and stable and unaffected by temperature or battery changes. Unlike frame lines inserted at the monitor, raising the intensity doesn't affect picture contrast. Each input and output is crisp and isolated, and the option to send any level of frame line intensity to the director via the transmitter is terrific.

MONITOR:

It's sensational. My 1:1.85 image fills the large 16:9 screen, with just enough room to see slightly outside 1.85. The assistants like the instantaneous pull switch that shows the full 4:3 image to check if flags, etc have crept into academy. I'm crazy about the new Level Indicator, and I found a great place to position its bottom bar - if you adjust it to exactly cover the bottom frame-line, it turns very visibly into a dashed line when either side shifts up to signal that you are slightly off level. I set it (via dip switch inside the electronics) at "f" which is the slowest setting . Larry McConkey likes it set as fast as possible (and does the slowing down within his remarkable patented brain).

MOTORIZED TRIM:

Figure 74
Master RF Gimbal

Can't say enough about this feature. I used it on "*Casino"* and on a number of one-day shoots, but hadn't worked with it on an entire picture until *"Bulworth"*. Initially the wireless trim was unreliable on the early Master Series, and I found that when my new Preston transmitter was near the rig, it sometimes even interfered with the latest version. I intend to order the new spread-spectrum Preston, but meanwhile I asked CP to uncoil the 'trim' receiver antenna from around the top of the post and just let it hang. I found that if I aimed it out on the side of the rig where I was working, motorized trim again became reliable. I use it on every shot. It allows the supreme in-flight adjustment of tilt and roll attitude, and since we are working every day with the 100mm (both on the dolly and on foot), any effort required to maintain correct tilt shows up as weaving in the picture. I am now addicted to remote-controlled trimming and wouldn't want to contemplate shooting the old way (like having to land the plane to trim its attitude). You forget the number of times within a shot that you would tweak fore-aft trim if you could, to eliminate the slight continuous pressure needed to maintain the frame. The new gimbal is so free that if your mag isn't exactly on the centerline, you can feel the side-to-side shift if the next mag is slightly heavier or lighter, and of course with any co-axial mag it is essential. Jonathan laughs if he hears the faint burping of my trim motors when we are working side-by-side.

PULL-APART INERTIA BOOST

I use it routinely to double the inertia for slow-moving scenes or for longer lenses. CP is contemplating a gyro option, but for everything we have done on this picture, this feature has made the difference. I also pull the monitor and battery apart in low-mode to compensate for the instability caused by the less-than-optimum low-mode hand position and to improve the already sensational visibility of the screen.

SLIM PROFILE:

This helps enormously to reduce fatigue. I have adjusted my internal sense of the space between me and the rig, and I find that now when I put on my IIIA, I am constantly hitting the battery against my leg.

By the way, the NO TOOLS thing is great. The only tool we have to keep track of is the 1/4" Allen, and CP has experimented with a version of the socket block that even eliminates that if you are careful to adjust the rig when there is no load on the side/side screws. Incidentally, I even had CP change the trimmer for the Level Indicator to a knob, so that I can calibrate it without a tweaker to a bubble level on the camera when I change to low-mode.

THE ELITE

Jonathan and I have swapped rigs several times. The Elite is missing only the motorized stage, the Level Indicator and the larger 16:9 screen. To compensate, it is nearly two pounds lighter. Otherwise, it has all of the described features, and both rigs have earned the respect of our colleagues in the camera department. My assistant, the legendary Bill Clevenger says enthusiastically that this is the first Steadicam he had ever worked with that's a coherent 'System' ("It's a System, a real System!"), where all functions are co-ordinated to work together, with the minimum of fuss, and with every move designed to get the desired result, without screwing up some other adjustment or requiring additional maneuvers with tools. For example, the INSTANT **LOW-MODE** change (with no trim shift) leaves only one tweak, the near-immediate readjustment of bottom heaviness with the snap gimble clamp. Karl Linde (2nd), Bill and I routinely make a leisurely switch to low-mode in under two minutes. There are a number of other things the guys like - the battery/inverter system is dead easy to keep track of because of the onscreen display, and I think it requires fewer battery changes than anything on the market. We use batteries until we go from five 'lights' down to one before changing (several mags). The final step is 'one blinking' which indicates that a change is mandatory if a long shot is contemplated. Transmitters and recorders mount at nearly the center of balance, so they have almost no effect on dynamic balance, and the rig has fewer plugs and cables than anything out there.

All this has been a revelation. The Master Series was designed several years ago, and now I am pleased to report that almost every advance we attempted seems to have paid off. Quibbles: the hump for the electronics module is mildly annoying - not as bad as I thought it might be. It inhibits 'switches' every now and then in low mode. This should be easily fixed in the future. Also I had some stage vibration when running hardmount on a dolly on rough pavement at 100mm. I found this on my rig, but not on Jonathan's, and it proved to be two loose screws that hold my top dovetail assembly. For extreme

cases, CP makes a wedge clamp that locks the stage, but this costs you the opportunity to use the motorized stage, which I would regret. Otherwise, I wish I had a termination switch, in case I should ever have to use a t-connector at the bnc to service some extra future video device. I am a fairly straight-ahead operator of this machine. I have never owned a long post and prefer to ride on a doorway dolly to get the lens down on the deck. I used gyros on my very first prototype and dumped them because of the noise the time needed to run them up. I haven't missed them more than a few times in 20 years. Of course I wouldn't mind having a pair in reserve for those hypothetical windy long-lens title shots, but I believe that CP will very soon offer the option. What else? I never pan the monitor off the fore/aft axis. I prefer riding rather than running, but I own a Provid and would use it with an Arri if required. Anyway, I understand that CP has one in the works. In general, I'm quite happy with this rig, and would be glad to answer any one-on-one questions via e-mail.

I wish you good shooting.

Garrett Brown

Figure 75 Garrett Brown, Vitorrio Storaro, Jonathon Brown on *"Bulworth"* Movicam SL's on Master Film, Elite

George Paddock Incorporated Paddock Radical Options

PRO

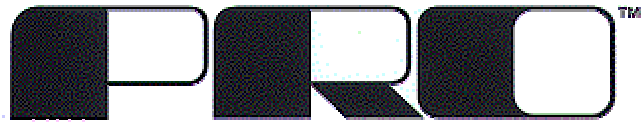


Figure 76 PRO Logo

The PRO system was released in 1991 in direct competition with Cinema Products 3A the PRO was a vastly superior system and it was due to this head to head competition that CP developed the Master Series.

I believe that the PRO system is superior to the Master Series. It is completely modular and it was designed by operators with emphasis being placed on solving real world problems – such as attachment points for accessories.

PRO System[18]

The PRO is an open, modular system. It is designed to incorporate state of the art developments in camera stabilization and supporting accessory technologies. Recent benefits of this philosophy are the Gyro Module, PRO Lite, and SuperPost, along with the new PRO Arm.

Upgrades and components allow the operator to tailor the package to his or her needs and market. As newer technologies are developed they can be easily incorporated into the PRO system

[18] Excerpt from GPI PRO System Catalogue

Designed & built by operators to meet the critical demands and requirements of today's filmmakers, the PRO incorporates the
principles of...

- **Modularity**
  All PRO system components and modules are interchangeable.

- **Simplicity**
  Reduces the amount of setup time required.

- **Reliability**
  Minimizes equipment downtime.

Figure 77 PRO System

- **Versatility**
  Configured easily to meet various shot requirements.

PRO Arm

- Incorporates the finest of materials and structural design principles in order to achieve the highest standards of strength and rigidity.
- A departure from traditional tensioning methods has resulted in minimal friction and a force curve designed to complement an operator's instincts.
- In keeping with our philosophy the arm is modular, simple, reliable, and easily maintained in the field.

Figure 78 PRO Arm

- In accordance with our commitment to modularity, the arm is easily configured to accommodate a wide variety of load requirements - load capacity ranges from 13 - 75 pounds.

Donkey Box

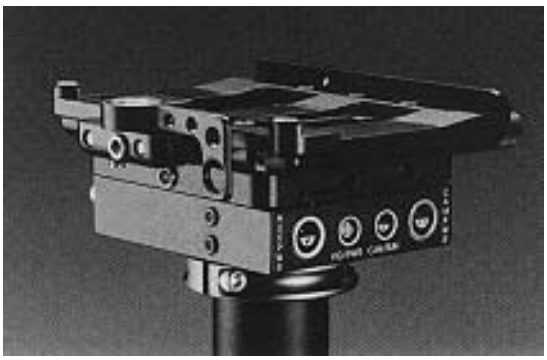


Figure 79 PRO Donkey Box

Linear slide bearings have replaced the old dovetail metal-on-metal design, allowing smoother, easier movement fore/aft and side/side.

Finer thread lead screws and captured lead nuts enable the operator to make smaller, more accurate adjustments.

A quick release mechanism eliminates the need for sliding the camera dovetail plate onto the Donkey Box, which allows for faster, easier mounting and dismounting of the camera

Gimbal

Design and construction guarantee a precise intersection of all three axes, while the correct application of bearings provide a smooth, deflection-free pan, roll and tilt.

Locking mechanism achieves concentric clamping about the post, ensuring that all axes converge at post center.

The PRO Gimbal is compatible with all 1.5-inch center posts and existing over-sized grips.

Figure 80 PRO Gimbal

5" Diagonal High Intensity Monitor II

Second generation, self-contained design incorporates all electronic components within a water-resistant housing, allowing for immediate substitution in the event of damage

High voltage, high intensity screen features familiar on-screen graphics and indicators such as framelines, crosshair, low battery and level indicators.

Figure 81 PRO Monitor

Improved brightness and contrast, image orientation, standard/anamorphic and graphic controls are all located on the face plate for easy adjustment

Post

- New post system was designed to eliminate all external cables except the monitor cable.
- Upper Junction Box and 17 1/2 inch - 26 1/2 inch extendable post, housing one internal cable, connects to the lower Junction Box via a bayonet mount. A quick disconnect/connect is all it takes to change from one module to another.
- Utilized with the PRO battery, PRO Lite and PRO Gyro modules.

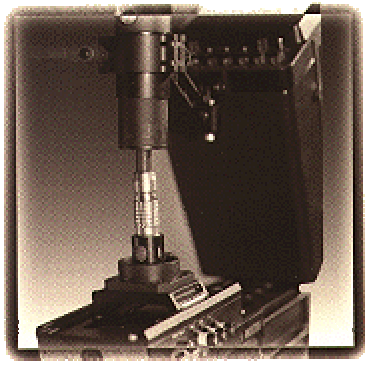


Figure 82 PRO Lemo Plug Base of Post

Batteries

Figure 83 PRO Battery

Each battery delivers 13.2 volts @ 2.8 amp hours providing a combined total of almost 9 amp hours.

Numeric LED display on each battery provides immediate readout of battery condition under load.

Weight is 2.4 lbs. per battery.

Built for use with PRO battery module

Battery Module

- Lightweight, skeletonized frame with a narrow (3.5 inch) footprint.
- Positive locking latch and Delrin slide rails allow smooth battery replacement while ensuring a snug, secure fit.
- Three battery system provides an independent and clean power supply to the monitor and video related accessories, while eliminating the need for a converter when running 24 volt cameras.
- Accommodates additional accessories such as a video recorder and transmitter.

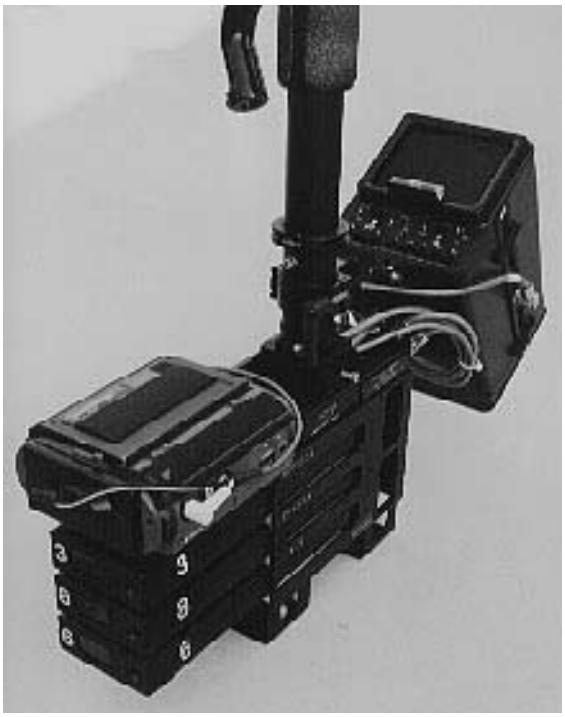


Figure 84 PRO Battery Module with Sony 8mm Recorder

- Batteries can be easily switched to parallel or series, providing 12 or 24 volts, or to separate for High-Speed Arri cameras.
- When running 12-volt cameras, one battery may be removed to provide a lighter system.

PRO Lite

- Approximately 3 lbs. lighter than the PRO battery module and applied best as a running or lightweight rig.
- Flies professional video, 16mm and 35mm cameras depending on the weight of the batteries used:

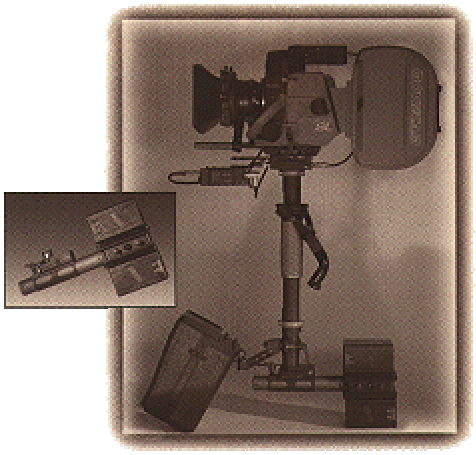


Figure 85 PRO Lite with Moviecam

PRO Gyro Module

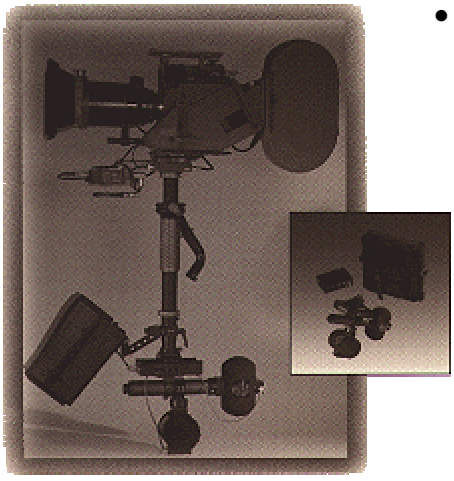


Figure 86 PRO Gyro

- Designed specifically for situations that require extra stabilization such as shooting in high wind or on a
vehicle mount.
Two KS6 gyros weigh approximately the same and replace the PRO battery module.
Sled and gyros are powered by three PRO batteries and an inverter; all housed in a back pack that attaches to the vest.
- Gyro power inverter features auto-select 12/24 volt input.
- 12/24-volt camera capability is identical to the PRO battery module.

SuperPost

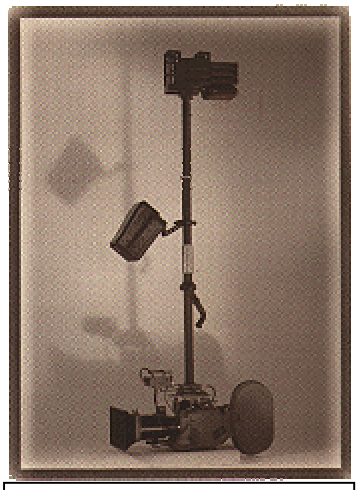


Figure 87 PRO SuperPost Lo-mode

Allows the operator to achieve super hi/lo mode shots.

Post extends from 51 to 60 inches (5 ft).

Same design configuration as the PRO post.

Utilized with the PRO battery, PRO Lite, and PRO Gyro modules

PRO Price List

SLED:

GPI Centerpost Assembly	$2,250
Monitor	$15,000
Battery System - includes 9 batteries, recorder mount, transmitter mount, and a monitor mounting assembly	$9,100
Donkey Box Assembly	$2,500
Gimbal	$5,000
Accessories - includes camera mounting plates, oversize grips, docking bracket & clamps, electronic level sensor (approx.)	$2,700
PRO Cable Package (approx.)	$1370
PRO Sled Case	$290
PRO Battery Case	$190
PRO Arm & Vest Case	$275

ARM

Recommended Packages:

PRO Arm including 8 Spring Canisters: 4 light & 4 heavy (for load capacities from 13-72 lbs.)	$20,000
PRO Arm including 6 Spring Canisters: 4 light & 2 heavy (for load capacities from 13-63 lbs.)	$19,000

Components (if purchased separately):

PRO Arm Chassis	$15,000
PRO Arm Spring Canisters (light or heavy spring)	$1,250 each

PRO MODULES

PRO Lite - includes 4 Anton Bauer Compact batteries	$3,750
PRO Gyro System - this price includes 2 - K6 gyros, backpack, etc.	$12,500
PRO Superpost - includes case.	$2,800

PRO VEST

Although a vest is not currently being sold. One is on the drawing boards and an advertisement was placed in *American Cinematographer Magazine*, June 1998 issue, advertising the new PRO vest.

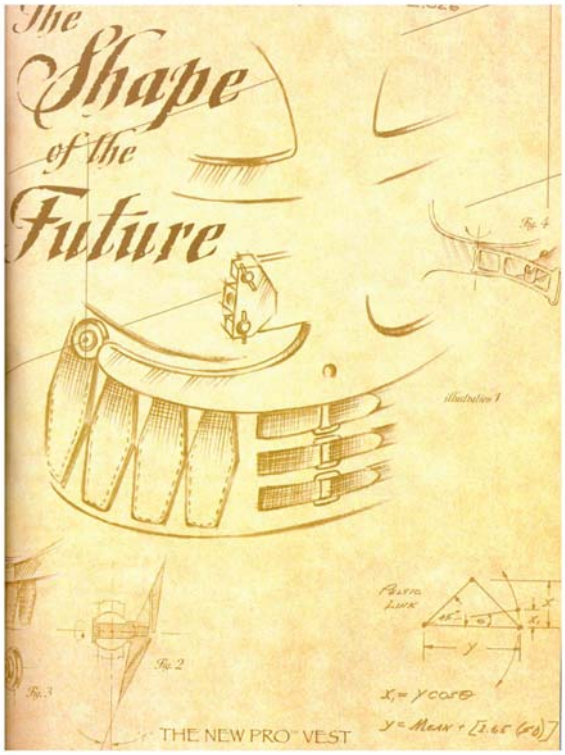


Figure 88 PRO Vest Advert

Cinema Products Master Series vs. George Paddock Incorporated PRO

Figure 89 Cinema Products Steadicam Logo

vs.

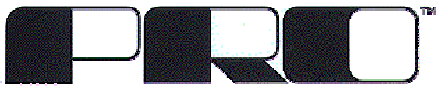


Figure 90 George Paddock Inc. PRO Logo

The two companies have both made excellent Steadicam's and this competition is a good thing. Especially now that CP has followed GPI's lead and is selling its components separately. This allows operators to mix and match the various components to create their own customized system.

For the Master Series:

The isoelastic arm is very good, the sled has a very slim profile and is very easy to move around. The motorized stage is very nice. The rig looks very futuristic. It is quick to switch to lo-mode. No tools adjustment is a huge timesaver.

Against the Master Series:

A 12:24 volt converter is needed with many cameras, there are not many practical attachment points for accessories. The base of the post cannot be moved on the sled, the monitor is in a pretty fixed position, the single battery means that focus motors have to be recalibrated every time the battery is changed.

For the Pro:

The modular system is easily adjusted/configured/repaired. Accessories can be added easily, its simply mechanical construction is easily repaired in the field. 3 batteries solve any power supply problems.

Against the PRO:

The mechanical design looks a little chunky and old fashioned, the battery module sticks out a little far, tools are needed for all adjustments.

Both of the systems have their respective advantages and disadvantages. It is I feel a matter of deciding what the rig is going to be used for and what features are needed to achieve that. A very viable option is to buy the components separately and build your own dream Steadicam.

New Zealand Steadicam Operator Peter McCaffrey[19] recommends this approach. His dream system would be a PRO sled, a Master Series arm and a IIIA vest. Although he stresses that the problems with the Master Series will probably be addressed over the next few years and it could then be a very attractive option.

Steadicam Accessories

The only limit to the number of Steadicam accessories that a Steadicam operator can justify needing; is his credit limit! There are three categories of accessories.

1. Accessories that are needed on a day to day basis to get the shot.
2. Accessories that make things easier and are nice to own.
3. Accessories that are purely the stuff of dreams. Such as custom made exotic material clad gadgets that are used mostly for boast value!

Accessories that are needed on a day to day basis to get the shot.

Follow Focus

The most important accessory is the follow focus system. There is no point in having the best rig if your shots aren't going to be in focus.

Figure 91 Preston Follow Focus Transmitter

Follow focus units consist of a wireless transmitter (usually FM or Microwave) that talks to a wireless receiver mounted on the Steadicam which drives one or more servo motors connected to the lens via a series of gears. This unit is operated by the camera assistant who has the ability to alter focus, iris or zoom.

The best follow focus is the Preston. It is also the most expensive at US$20,000.00
The Seitz is an older unit. It is reliable and very common. A second hand unit with many accessories can be found for approximately US$6,500.00
There are Heden and Cinema Products units available, but their reputation isn't as good as the above mentioned models.

[19] Peter McCaffrey is arguably New Zealand's best Steadicam Operator. He is currently working on *"Hercules. The Legendary Journeys".* He uses a PRO with a IIIA arm and vest.

Video Transmitter

A wireless video transmitter is required for the director to see the shot. Like the follow focus these units usually use the UHF, FM or Microwave bandwidth. At the most basic level any video transmitter will do the job, but for the best picture quality, reliability and weight it pays to use professional products.

Figure 92 Modulus 3000 Video Transmitter

The most popular and arguably the best unit is the Modulus 3000 (2" X 3" X 1 3/8") weighing 5 ounces. It is priced at US$1,900.00

Video Receiver

In order to receive the transmitted video image a reliable multi channel video receiver is necessary. There is a huge variety in both the functions and the cost. You can spend anywhere from several hundred to tens of thousands of dollars. The best place to find out more about these units is at Wolf Seeburg Video USA: www.primenet.com/~wolfvid/w2wfrm.htm

Figure 93 Video Receiver on Sony Combo

Brackets and Cables

A huge selection of brackets and cables are needed. Basically you need to be able to make any camera package work with a variety of accessories on your sled in both standard and low mode. Quite often the low mode brackets will have to be custom made. Although you can find a good selection for sale at: Jerry Hill Steadicam, Phone: +001 (818) 986-5556 , Fax: +001 (818) 986-5222.

Accessories that make things easier and are nice to own.

Antlers

Figure 94 Antlers on Lightweight II *"As Good as it Gets"*

The most popular of these at the moment is a set of Antlers, or 'Inertial Augmentation System'. They essentially do just that, adding inertia to the Steadicam rig by extending mass and thus making it easier to control – especially in windy situations. They cost roughly US$1000.00 and are available through Gene Taylor: Phone +001 562 424 9941.

On Board Video Recorder

An on board video recorder makes a great back up to the video transmitter. It also allows the operator to review the shot without docking the Steadicam and moving to video village.

Figure 95 Sony 8mm Watchman

The most common in the Sony 8mm Watchman, available from most local appliance stores for approximately US$500.00.
DV format recorders are becoming more widely used due to their small size and better picture quality. At this stage there is still no favored model.

Accessories that are purely the stuff of dreams.

Gyros

Figure 96 PRO Hard Mount, Two Gyros

Gyros are on the wish list of every Steadicam Operator. They add inertia and the correct use of one gyro will add stability to one axis (in that it is harder to move that axis), so that the axis becomes more stable and the operators unforced errors or slight mis-judgements have less effect on the stability of the shot. With 3 gyros correctly mounted the operator can cover all 3 axis.

The PRO Gyro System from GPI includes 2 K6 gyros for US$12,500.00 Phone +001 (800) 390 3991.

For the most part accessories consist of a myriad of tools; cables, gadgets and home made contraptions.

Preferred Steadicam Cameras

Currently I believe that the best camera for Steadicam use is the MovieCam SL. The SL is a very lightweight camera at 7.8 lbs. It has been designed for Steadicam and handheld use – but without compromising registration with dual registration pins and dual pull-down claws, a variable shutter, and quartz crystal accurate speeds from 12 to 40 fps. The magazine is a vertical displacement 400` load and as such it is very Steadicam friendly.

Figure 97 Moviecam SL in Low-mode Cage

Other good Steadicam Cameras include the Panaflex Lightweight II, and for MOS shooting, the Arriflex 435.

However these cameras are expensive and more often that not the Steadicam Operator is presented with a heavy Arri BL3, or even a BL4! Despite being heavier all good operators are able to handle these cameras with ease and most standard shots are still achievable with these older heavier camera packages.

Figure 98 Panaflex Lightweight II with Antlers

How to become a Steadicam Operator

Steadicam Workshops

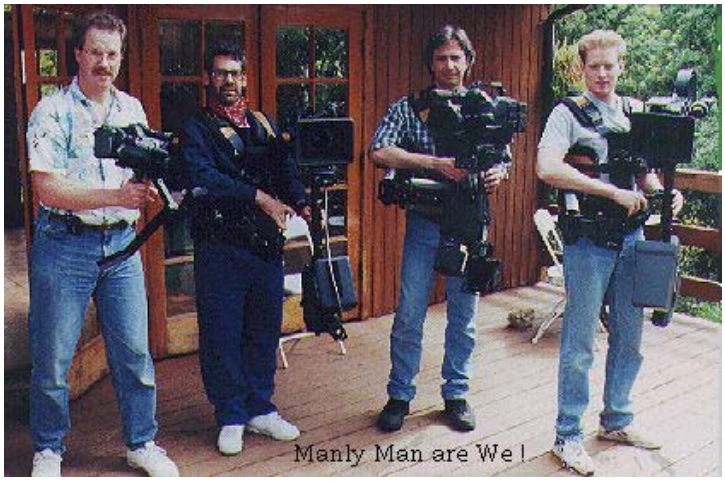


Figure 99 Steadicam Workshop Line-up

The easiest way to learn about Steadicam is to attend a Steadicam workshop. There are a variety of workshops that you can attend worldwide. The most recognized of these is "The Malibu Classic Steadicam workshop"[20] in Malibu, California. It is an annual workshop run by Cinema Products and endorsed by the Steadicam Operators Association.

It is necessary to have a background in film or television to attend and a reasonable standard of fitness is required. Alternatively try contacting a Steadicam Operator in your area. Usually they are only too keen to help out and show you the basics. This is probably how they started out themselves.

Other Steadicam workshops are run by:

- The Steadicam Operators Association. +001 (1-800-CALLCAM), E-mail: callcam@aol.com
- The International Film Workshops in Rockport, Maine, USA +001 (207) 2368581.
- Optex in north London, UK +44 (0) 181 441 2199

Cinema Products Corporation

Cinema Products Corporation

Figure 100 Cinema Products Logo

+001 (310) 8367991

STEADICAM ADVANCED TRAINING WORKSHOP[21]

The Advanced Training Workshop is geared toward the individual who desires to become a Steadicam Operator in the Feature-Film, Broadcast or Video Industry. All aspects of operating are covered including: mounting and balance, vehicle-mount, low-mode, staircase and running, as well as Follow-Focus set-up and operation.

All instructors are Professional Steadicam Operators and in addition to teaching you how to operate, they will also advise you on marketing yourself; how to survive on a film set (especially as a day-player); how to train an assistant; must-have tools and accessories; and they will critique famous Steadicam shots from Feature-Films, all in a class room environment that will provide the aspiring Steadicam Operator with the most comprehensive training available.

The Workshop is held at the Calamigos Ranch in the Santa Monica Mountains above Malibu in a beautiful rustic setting. We recommend that even the local students stay at the ranch to take full advantage of the opportunity to practice with our equipment as much a possible. Also, after class hours there are usually informal discussion sessions with the instructors which past students have told us are invaluable to the Steadicam Operator-in-training.

The Workshop will start you on the road to becoming an operator and at the Workshop you will make friends and acquaintances who will assist you as you travel the road that leads to the "Last great job in the Movie Business".

[21] Publicity Letter from Cinema Products Promoting the Steadicam Workshop.

CINEMA PRODUCTS CORPORATION[22]

DEAR WORKSHOP ATTENDEE:

FOLLOWING IS INFORMATION ON THE UPCOMING WORKSHOP.

SUNDAY: REGISTRATION BEGINS AT 1O:OOAM AND STUDENTS WHO ARE STAYING AT THE INN SHOULD ARRIVE AS CLOSE TO 10:OOAM AS POSSIBLE SO YOU CAN FIND YOUR ROOMS AND PUT AWAY YOUR LUGGAGE. THE CLASS WILL BEGIN AT 11:OOAM SHARP. MOST OF THE DAY WILL BE LECTURES AND LATE AFTERNOON YOU WILL BUILD THE RIGS & GET INTO THE SUIT FOR THE FIRST TIME.

MONDAY: EXERCISES WILL BE LAID OUT AND THESE WILL BE USED THROUGHOUT THE WEEK.

TUESDAY: LOTS OF BASICS AND PRACTICE, PRACTICE, PRACTICE.

WEDNESDAY: LOW-MODE (ALSO KNOWN AS @#&#O/O@!! AND OTHER UNPRINTABLE NAMES)*

THURSDAY: (WEATHER PERMITTING): VEHICLE MOUNT, TITAN CRANE, MOTOCAM.

FRIDAY: GRAN PRIX TEST SHOT. AT THE END OF THE DAY THERE WILL BE A BANQUET AT WHICH THE CERTIFICATES OF COMPLETION WILL BE GIVEN OUT ALONG WITH HATS AND T-SHIRTS.
THERE WILL BE A SHORT FILM CALLED: A DAY IN THE LIFE OF A STEADICAM OPERATOR, STARRING THE LATE, GREAT TED CHURCHILL, AND POSSIBLY OTHER SURPRISES.

[22] Letter from Cinema Products Detailing the Malibu Classic Steadicam Workshop 1997.

CLOTHING: COMFORTABLE SHOES WITH SOFT SOLES AND LOTS OF SOCKS AND T-SHIRTS. ALSO BRING A PAIR OF SHORTS. LA WEATHER IS UNPREDICTABLE IN THE AUTUMN SO ALSO BRING WARM CLOTHING AND RAIN GEAR.

NOTEBOOKS: WE PROVIDE THEM BUT BRING PENS & PENCILS.

CAMERAS: BRING A STILL CAMERA AND IF YOU HAVE A CAMCORDER YOU MAY WISH TO HAVE THAT WITH YOU AS WELL. STUDENTS WITHOUT CAMERAS USUALLY REGRET THAT THEY DID NOT BRING ONE.

Figure 101 Student, Ben Ruffell with Panaflex Lightweight II on Master Film, Charles Papert Steadicam Instructor on right at Malibu Classic `97

Figure 102 Malibu Classic Steadicam Workshop `97

Physical Requirements

Despite widespread general perception Steadicam is not damaging to your back. In fact it builds the back muscles involved, and so over a period of time the physical requirements become less taxing. Many seasoned Steadicam Operators believe that their backs are in great condition and that they are far less likely to suffer from back pain that others.

A reasonable standard of fitness is required, and you should not undertake Steadicam training if you already suffer from any ailments.

To stay in shape I strongly recommend In-line Skating or In-line Hockey. I've found that this works many of the same muscles that are involved in Steadicam operation. Hyper–extensions, reverse pec-deck and seated row are all exercises of value. Visit a personal trainer or physiotherapist, and if

Figure 103 Geoff Mart with IMAX on Master Film

possible demonstrate the rig to them. They will be able to tailor a unique package for you.

Steadicam use in New Zealand

Steadicam use in New Zealand is very limited – mainly being found on high budget overseas funded drama and commercials. Steadicam however is not a new thing in New Zealand. Film Facilities had an early Model II which was used extensively. John Mahaffie (currently DP on "Hercules") was an early camera assistant to Garrett Brown, and has contributed a lot to Steadicam as we know it today. He brought the first Model 3A into the country and founded Steadicam New Zealand – a company that he is now in partnership with, with Peter McCaffrey – arguably New Zealand's best Steadicam operator.

Steadicam New Zealand owns a PRO, complete with a late 3A arm, Preston follow focus, a gyro, antlers, modulus video transmitter, a selection of low-mode cages, brackets and cages. It is the number one rig in the country.

Steadicam New Zealand's back-up rig is a 3A, it has a variety of accessories, a Seitz follow focus and has had some modifications made to it.

John Cavill owns a highly modified 3A with a variety of accessories and a Criozel follow focus. He also has an EFP as his back-up rig.

Neil Cervin has a 3A, which has been modified slightly.

Steadicam use in New Zealand is mainly found on Pacific Renaissance Pictures productions, with Steadicam New Zealand supplying the TV Series “Hercules: The Legendary Journeys” with it’s PRO and operator Peter McCaffrey full time. John Mahaffie is the Director of Photography and still operates occasionally.

John Cavill’s rig is used on “Xena: Warrior Princess” full time with Cameron McClean operating full time. Although he still operates, John Cavill is working as a full time Director of Photography.

This comprises the bulk of the Steadicam work in New Zealand although Steadicam can still be found on feature films, Commercials, Sports, TV Shows and Music Videos. The operators comprising of:

Rick Allender, Richard Bluck, Phil Burchell, Neil Cervin, Rhys Duncan, Dana Little and Jerry Vasbender.

This situation isn’t likely to change a great deal in the near future, although there is always talk amongst the various operators about new models and possible upgrades.

SET SURVIVAL[23]

The world of the Steadicam operator is a glorious one but one rife with pitfalls awaiting the unsuspecting as well. Although many of the harsh realities you'll face are technical in nature (whether you can make the shot or no), some of the worst are political. Never forget that although an artist, you're also just another camera operator facing the same difficulties, the same challenges and threats as your peers on the wheels. Although you carry a state-of-the-art tool, your value is still measured by economic viability; if you and machine are no faster than the time it takes to set up dolly and track, you may have a short career. Because many still no little of this machine, they are apt to be more worried about it to begin with. Always keep this in mind.

[23] From “The Steadicam Letter” Vol. 1 No. 1

The key to success is speed, the key to speed is organization, the key to organization is knowing how to communicate effectively to get things you want done. Many a Steadicam operator has been buried because he/she either failed to request the right help or asked for it in the wrong way.

Many see the instrument as threat. Look in the mirror with the machine on and imagine how a normal camera operator or grip would see you on the set. Is that image apt to make them nervous? You bet. There will be those who are threatened by your mere presence on the set. Remember: you're probably taking at least one other person's job- albeit temporarily. They may look at you with anything from mild amusement to adoration, but given the opportunity, a few would probably like to sink a knife in your throat. Steadicam is a very, very powerful tool; as master of it, you are in a highly advantageous position- but a delicate one.

Watch your set karma. Steadicam operators are not humble by their nature. Don't let the hotshot gunfighter mentality rule your persona; it could create problems for you later. It's easy to nail a few great shots in a morning, look great, then run up against a real nasty later in the day and look like hell. So practice humility always. If you act condescending to those around you, they may not be there to support you later when you need them.

You must be a patient teacher. Even after years, many people still don't know what this machine does to say nothing of how the hell it works. If you want the help you'll undoubtedly need, you're going to have to spend some time showing others the ins and outs of the thing. That goes from directors to grips to drivers. If you treat them well, you can easily make them feel like part of the process and they will kill themselves for you; if you're impatient or abusive, they'll drop out and you'll be left out there all alone believe me, a position you don't want to be in.

Don't oversell the instrument. Many an operator has crashed and burned because they stated there was no situation they couldn't handle. If you're reasonably confident you can do a shot you've never tried before, by all means go for it. But be careful. If you try something beyond your level of skill and blow it, you may end up costing the production lots of bucks, a sin which they may or may not be able to

forgive. The value of experience is as much in knowing what you can and can't do as in being a good camera operator.

Use conventional equipment around you if necessary. I've mounted the machine on almost everything capable of moving faster than I could safely or comfortably travel: motorcycles, cars, vans, camera cars, pickup tricks, western dollies, cranes and God knows what all. It's no embarrassment to want to avoid a broken leg, double hernia or snapped spine. You're not a stunt person, just a camera operator. Don't let others talk you into anything that may harm you; you are the one who knows about this thing, not them.

Understand the elements of the shot before you commit. Find Out precisely what director and/or DOP have in mind. What are their expectations? If they've had previous experience with the device, was it good or bad? Can the shot be gotten quickly or will it take some time? If you can accurately predict the elements involved, everyone can relax; if you can't, you'll drive them nuts.

Attempt to instill an aura of self-confidence. Even if you're scared shitless, act like a professional. I wing it all the time; it's no big deal to be on the edge of your skill. Provided you don't look like it all the time. The first shot is very important. If you ace it, you can relax a bit. If you don't, you'll have to work all that harder to get their confidence later.

Develop a rapport with all those around you. You may feel quite independent, but you'll undoubtedly need the help of many other departments from grip, electric, assistant directors, the other camera crew.

Learn their names when you get there and remember them. Introduce yourself early. Let them know what you might need. Make friends, demonstrate the machine if you have the time. Get people interested in helping you.

Be a futurist. The ability to be a star with this thing is the ability to see problems before they occur. Never overlook anything; assume there are going to be problems and prepare yourself for them beforehand.

Always attend rushes/dailies. Anyone who doesn't want to see his/her work probably shouldn't be doing it. No matter how good you are, there's always more to learn. If things went well, you can bask in glory; if poorly, you can 1. Defend yourself, 2. Learn from the experience and 3. Gain a bit of humility and caution when you confront the next one.

Remember the shot you just made. Second to second, things change at an alarming rate with this machine. Director and DP will want to know how a shot was, where there were problems. You must be able to tell them precisely and correct imperfections for the next take.

No cuts/no coverage. Steadicam shots can be long and involved, often with no footage shot to intercut. A take has to be good all the way through. If the headroom is bad for just a few seconds, the whole take might be unusable. Find out beforehand whether they're going to pop singles along the way, do wide coverage or inserts. If the shot is really tough, it may wave you having to struggle through the whole thing at once.

Never assume anything. Somewhere in your career there will be a flare, flag, gripstand, electrical cable, production assistant, gawker or a host of other undesirable elements in frame you never saw in the monitor. Always check the shot will you eyes before you shoot. At dailies, no one gives a damn if your screen is poor. So watch it always.

Give the AC enough time to get good focus marks. Pulling for Steadicam is one of the most difficult tricks in the book; many of the best assistants I know will not even look at the machine because they've heard many stories of disaster. You want to be efficient but if the shot's soft, it's unusable. So make sure the person pulling focus/iris has it down solid.

Don't eat huge meals before you have to do a strenuous shot; the machine will double or triple in weight. Throwing up on the director after a shot is not at all what either of you had in mind I'm sure.

Rehearse the shot as much as you can but not to the point where they think you may not be able to do it. See where potential problems might occur.

Make sure all film-related equipment is well out of frame.

Designing the shot. Lighting for Steadicam is a killer in many cases. If you're the one designing the shot, don't give the DOP a near impossible lighting challenge; the move might look great in the film but you also might not work for the DOP again. Always try to make everyone involved around you look good as well.

You're a camera operator first. Your shots are most likely going to be evaluated as if you were on a dolly with the wheels. If they look inferior, no one is going to forgive you because you appeared to struggle while doing them. You may only have to live through watching them twice; the director may have to three hundred times.

You must be highly organized. Doing Steadicam is like a military operation. If everyone is trained to move like clockwork, the battle is won; if they fall apart under pressure, you're dead meat. Have all the accessories you'll need within arm's reach, all tools handy, backup systems (like excuses) ready to go.

Pace yourself. There's something about Steadicam that makes productions want to go fast. Don't get caught up in the machine's rhythm to the point you're apt to overlook something. It is. possible to go too fast with this thing; it's happened to me time after time. If you find yourself in such a situation, slow it down. You'll be happy you did at the dailies.

Evaluation the production's expectations. There's no need to kill yourself take after take to make the shot perfect if there's no requirement to do so.
Compromise is often the name of the game. You'll be continually balancing perfection against economics; a less then perfect shot is not the end of the world, six hours of overtime for the entire crew can be.

Be careful about what's in frame. In the Steadicam monitor you see about one-tenth the detail you would were you looking through a conventional camera. It's very hard to see flare, sand bags, grip stands, street people, wandering frame, extras looking at the camera. Watch out. If possible, have someone (preferably your assistant and a PA) constantly checking this stuff for you.

Don't do anything dangerous. You might think the challenge is worth it at the moment but you may have second thoughts in your hospital room later. There are many, many ways to harm yourself with this instrument if you're not careful. Great work is not a function of athletics so much as it is of agility, intuition and being a great operator to begin with; you're a ballet dancer, not Rambo.

It's only as movie. If you're committed to this instrument, you'll always want to do the best work possible. But in the process, the pressures can be enormous. Don't let your lust to achieve greatness with this thing become so important you overlook relationships with those around you. Although Steadicam may be paramount to you; many could care less about it. Always take the time to maintain the human aspect with those around you; part of your reputation will be based on it. Despite what others may think, films are not more important than people.

Working with assistants[24]

The primary jobs of the Steadicam camera assistant are exactly the same as for a regular camera assistant: making sure the camera and lenses are operating properly and that focus is correct. It's better to have a Camera assistant who can pull focus well than someone who knows the intimate details of dynamic balance or where you like to keep your spare 1fl32 screws.

With this in mind, an assistant who is used to the added challenges of pulling focus for a wandering, energetic camera and one who is willing and eager to learn about the Steadicam in general and you, your rig, accessories, and preferences in particular, is a most valuable member of your team.

[24] From Malibu Classic Steadicam Workshop Handout, January `97

Let's face it a Steadicam operator needs all the help he can get, and having your own highly trained and motivated assistant is a big plus. The more he knows about Steadicam, the more he can help you through the tough moments, the politics, the trip to low-mode, etc. The more you have to train someone, the less time you have to consider the needs of the shot.

A good Steadicam assistant will quietly ascertain what gear you have and how it is organized - what's in what case, how many batteries and chargers, what sort of follow-focus unit do you have, how many motors,
Video assist, video transmission, video recording, etc. He will also determine the exact amount of help you desire with your gear and listen to your preferences.

A bad assistant will ignore the "Steadicam" parts of the camera gear (leaving them to you to deal with) and he will complain about Steadicam to everyone within earshot, or, at the opposite end of the spectrum, he will pester you about every odd gadget you happen to have in your cases and how you like your coffee at the same time as you are trying to talk to the DP about the next shot.

You can help your assistant by being sure that all your gear works well with the camera equipment du jour, by being organized, and by having adequate backups. You should support him when he needs more time to get focus marks, reset your servo motors, check for flare and build flags for you lens, etc. Don't tell the AD "five minutes" when your assistant needs ten. Treat him well. It will show up in dailies where it all matters.

Figure 105 Steadicam Operator Peter McCaffrey

Figure 104

Your assistant can help you by setting up and balancing your equipment, checking for flares and other bogeys, being sure there are plenty of fresh batteries close by, watching out for your safety, checking your equipment for potential catastrophic disasters

(broken hinge pins, loose or missing screws), making sure you have plenty of water, and perhaps suggesting (out of earshot of others) small matters of framing and timing, etc.

You may find that you like having an assistant who sets up all your gear for you, or you may prefer to do many things yourself. Working out who does what on a fast switch to low-mode can be amusing as well.

Cost of Hire

Figure 106 SOA Logo

The cost of hiring a Steadicam Operator or a Steadicam varies greatly depending on your needs. The best thing to do is to contact a local operator or try the Steadicam Operators Association Phone: +001 1 800 CALL CAM.

As a rough guide, daily rate in Los Angeles including Operator and Steadicam Package.

Top Operator	US$3,000.00 per day
Average Operator	US$2,000.00 per day
New Operator	US$750.00 per day

Some rental houses have Steadicam packages for hire although they are usually in less than perfect condition. Many operators will only rent the Steadicam out with themselves included. Due to this it is difficult in some areas to get your hands on a Steadicam without purchasing one when you are starting out. The best thing I believe is to contact a local operator and ask their advice.

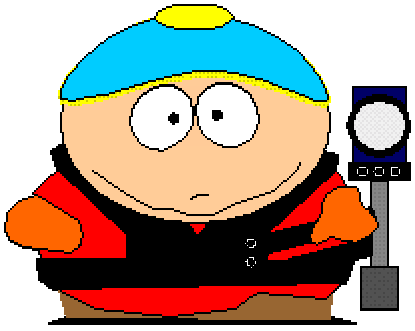


Figure 107 Cartman with Steadicam

Conclusion

Future of Steadicam

Predicting the future development of Steadicam is very difficult. In the near future I believe that Steadicam will evolve with the use of more exotic materials and some idiosyncrasies within the unit will be ironed out. I do not believe that the basic concept of the Steadicam will change greatly. A Steadicam will still be a camera on a stick with weight at the opposing end. However I expect to see more wide spread use of gyros and antlers – and with lighter 35mm cameras possibly even a combination of the two. Auto balance or a self-leveling rig could be on the drawing boards in the future. Garrett Brown is working closely with military aircraft systems designers to recreate their ‘self leveling’ feature.

I believe that the future of Steadicam is that there is no future for the big rigs. They (and the accompanying 35mm cameras) are about to face the threat of digital cameras. When 32bit technology is available to digital cameras they will equal the resolution of today's 35mm film cameras. The lighter, cheaper and possibly better alternative will hold appeal for producers and production people alike. These cameras will probably still require something to put them on – but if a Steadicam is used I believe that it will be a system very different to that employed today.

However, accompanying this rather bleak prediction I totally believe that there will still be a place for today's Steadicam Operators in future production roles. Someone still needs to point and move the camera. Composition, communication and experience will count for a great deal and these camera operators are able to provide that. Producers are still going to make multi million dollar feature films and the public is still going to see them. These Producers are not going to be employing a bunch of film students with a digital camera – no matter how good it is. The top workers in the film industry will still be the top workers in the industry, and as such they will continue to work in film production. The job titles and craft skills may change but people will always evolve to make the best use of the technology.

Appendix 1

Steadicam Operators in New Zealand

Richard Bluck
PO Box 510
Wellington

Ph. 025-449-124
04-389-8525

Phil Burchell
3B 41 Albert St
Auckland Central

Ph. 025-790-588
09-309-4470

John Cavill
PO Box 5378
Auckland

Ph. 025-960-140

Neil Cervin
43 Glan Rd
Devonport
Auckland

Ph. 025-973-957
09-445-4371

Rhys Duncan
7 Gallony Ave
Massey
Auckland

Ph. 025-831-622
09-833-9940

John Mahaffie
16 Grand View Rd
Auckland

Ph. 025-980-536
09-524-9567

Peter McCaffrey
PO Box 9065
Auckland

Ph. 025-948-194

Cameron Mclean
Cc Pacific Renaissance Pictures
PO Box 90409
Auckland Mail Center

Appendix 2

Useful Contact Details

Steadicam Operators Association

+001 215 CALL CAM

Cinema Products

+001 310 836 7991

Seitz Technical

+001 215 268 2228

DeRose Cinema Engineering
+001 818 982 8889

George Paddock Inc.
+001 818 3991

Frezzolini Electronics
+001 201 427 1160

Band Pro Film
+001 818 841 9655

Whitehouse Audio Visual
+001 805 498 4177

Glossary of Steadicam Terms

Aircraft Pin, n.
Probably a misnomer for any one of the pins that has a plunger and little retaining ball at the end. Also called the Safety Pin on the Docking Bracket and Parachute Pin on the arm. Sounds high-tech. Grenade Pin is not acceptable.

Aircraft Screws, n.
The two rod ends in the bottom of the arm that control the arm~s side-to-side lifting angle.

Arm, n.
The magic device with springs and hinges. Officially the Double Hinged Exoskeletal Articulated Spring Support Arm.

Arm. v.
To raise or lower the camera. to boom or crane or pedestal.

Bones, n.
The long, rigid support pieces of each parallelogram in the arm.

Bottom Heavy, adi.
Wherein rig is balanced top-to-bottom with too much bottom weight. Although the rig seeks vertical and feels very stable when not moving, it is very pendular and difficult to control when accelerating or decelerating.

Bubble, a.
Any mechanlcal or electronic level indicator. Not useful when accelerating, decelerating, or cornering. All bubbles on the sled must be slaved to camera level.

Bubble Tamer~, n.
An electrical circuit that makes electronic bubble displays watchable.

C.G., n.
Center of Gravity. Also c.g. An important concept.

Camera Mounting Assembly, n.
The combination of the post. monitor, electronics module, gimbal, junction box. and camera mounting platform. Called the sled because the Model I and II Steadicams had their electronics in a long thin box that looked like a sleigh. A.k~. Rig and system.

Chassis is a new term that was created to distinguish the EFP "sled" from the universal model sleds.

Camera Mounting Platform, n.
The section of the camera mounting assembly on the top of the telescoping support post that supports the junction box and mates with the standard clamp plate. A.k.a. stage because it has the ability to be adjusted in the X and Y axes.

Camera Mounting Post, IL
A 518 inch diameter p051 that is clamped to the end of the arm and inserted into the gimbal to lift the rig. Often called arm post and support post. Most often short post. The long post is rarely used.

Center Post, a.
The long tube rigidly connecting the counterweight to the camera which runs through the c.g. of the system. Telescoping Balance Post or Telescoping Post for those operators whose rigs have them. It's standard on the EFP and ~A but not on the Model 1,11, or m. Telescoping support post is used in the product literature. On the set, it is the POSL

Clamp Plate, IL
The plate that is attached to the bottom of the camera and slides into the camera mounting platform. Known as the Standard Clamp Plate because it's supplied with the rig. There are a few special purpose clamp plates for specific cameras. A.k.a. Dovetail because of its shape. Dovetail also is used as a verb. A.k.a camera balance plate,

Delrin,
The plastic sliders used in the Steadicam arms and by PRO in their battery mounting module. They offer a tight secure fit without any adverse wear after multiple use.

Don Juan, adj.
Used to describe the condition of shooting more or less to the rear. The opposite of Missionrry. Can also be used as a noun, the Don Juan, or a transitive verb, to Don Juan it.

Docking Bracket,
A custom bracket attached to a grip stand where the Steadicam can be left when unused. It can also be pivoted and used as a balancing post.

Dog Bones,
The main support braces on the Steadicam Arm.

Dynamic Balance, IL
The rig is in dynamic balance when the rig is panned rapidly and remains horizontal. The rig is out of dynamic balance when it tends to rise up or aim down as it is panned. A rig rnay be in static balance (be level when not rotated) but not be in dynamic balance. When
in dynamic balance, the rig is sweet. Dynamic balance is an advanced and somewhat complicated matter. Understanding dynamic balance is crucial to properly balancing your rig.

Electronics Module, n.
In the Model I and II Steadicams, this was the sled part of the camera mounting assembly. With the advent of the Model III the electronics module no longer looked like a sled and needed a new name. On the EFP, most of the electronics have been miniaturized and are part of the monitor. Therefore on the EFP this part is called the Power Module. On the Master Series, it's the K~section.

Follow Focus,
A wireless servo motor based lens control system used to adjust focus, iris and zoom. Operated by the Camera Assistant.

Garfield Mount,
Attached to the Steadicam Arm Socket Block end when Hard Mounting.

Gimbal,
A three axis gimbal that precisely intersects the center of the Steadicam centre of gravity and allows the operator to pan and tilt the rig.

Gyro, IL
A noisy, spinning, two-axis inertial stabilizer often erroneously presumed to be an integral part of the Steadicam. Used only under special circumstances as an accessory (once every 500 operator years).

Hard Mount,
When the Steadicam is attached directly to a vehicle or other solid object.

Iso-elastic,
The term used by Cinema Products to describe the adjustable float point charitiristics found on the Master Series Arms.

Locking Clamp, n.
A small wedge, spring. and screw arrangement that sometimes manages to keep the clamp plate from sliding forward and backwards between trim and balance adjustments on Model lIlA's, EFF's and earlier model Steadicams. A.k.a. lock or damp Jock. Thankfully replaced by Donkey Boxes or the motorized stage in the Master Series Steadicam

Low Mode, n.
Operating with the camera below the gimbal and the electronics, monitor, and sled above the gimbal. The opposite of High Mode. A.k.a. Underslung Mode which clearly describes the condition and gets away from the idea that the camera is skimming the floor as in Utra Low Mode. Never Lo-Mode.

Missionary, adj. See Don Juan.

Mitchell Mount,
An industry standard mount to which a Garfield Mount is attached to when Hard Mounting.

RF Controller,
Found on the Master Series Film, this allows the trim to be continuously adjusted throughout the shot without upsetting the balance of the Steadicam.

Safety Slideback Locking Screw, n.
The operator-adjustable screw that prevents the dovetail from sliding backwards out of the camera mounting platform. Commonly known as the safety screw. On IIIA's and earlier Steadicams, there's another little screw on the left front side of the camera that prevents the clamp plate from sliding forward out of the camera mounting platform. Although equally important, this specially machined screw has no name. It is often missing from the camera mounting platform. Check to be sure it is there.

Soft Mount,
When the Steadicam Operator wears the rig in the normal way. Directly attached to the rig via the vest and arm.

Switch, v.
To change from the Missionary to the Don Juan or vice versa. In the Philadelphia School it's change and making the change. Also switch,n.

Threads, IL
Not the operator's wardrobe, but the personal settings of the T-headed thumb screws in the socket block and the aircraft screws in the arm that determine the angle of lift of the arm.

Trunions,
The cable and pulley system located in all Cinema Products arms.

Ultra-Low Mode, n.
Where a lot of producers want your rate.

Additional Information

To find out more about Steadicam the best place to look is on the internet. Try a search for Steadicam or try these two pages. They are the most constructive.

http://www.steadicam.com/

Figure 108 Ben Ruffell with Garrett Brown, Malibu Classic 1997

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