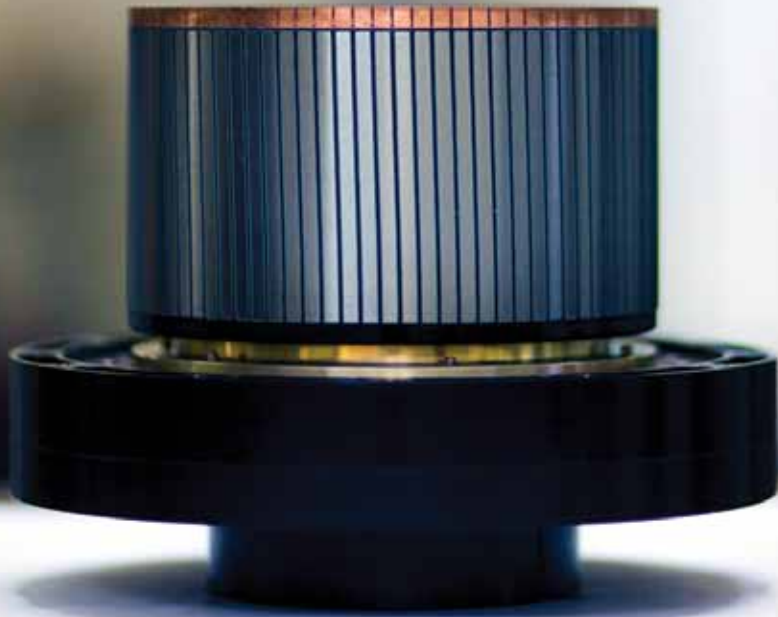


# Your Guide to Gyro-Stabilized Camera Systems



By E.F. "Bob" Nettmann





## Comparison of Gyro-Stabilized Camera Mounts for the Motion Picture Industry

By E.F. (Bob) Nettmann

*Originally published 2004 (updated 2011)*

Gyro Stabilization - the Film Industry's latest magic elixir for all the Cinematography ills caused by the common bump or shake. It's a term that's quickly gaining widespread popularity as a panacea for shaky camera images, but not all stabilizing systems are equal. This definitive guide will help production, operators and DPs alike to choose the right system for the right application. Budget consideration is minimal as most systems are competitively priced even across different categories. Lower quality systems are somewhat less in price than high quality systems. On average, ground based systems rent for \$1200.00 U.S.D. per day and aerial system packages rent for more than double. Too many times, a gyro stabilized system is rented and the limitations of that particular system manifest themselves on the production, giving a misunderstanding to the term "gyro stabilization."

**Definitions** The term gyroscope as defined by "American Heritage Dictionary" is: "a device consisting of a spinning mass, typically a disc or wheel mounted, on a base so that its axis can turn freely in one or more directions and thereby maintain its orientation regardless of any movement of the base". The "base" of the gyro-stabilized head is the support system to which the head is attached, whether it is a crane, camera car or helicopter. The "base motion" must be eliminated from affecting the picture. How well that is achieved is called the "bandwidth" of the system.

A low bandwidth design will STOP a percentage of low frequency motions from getting to the camera and shaking the image (i.e. rocking and rolling from a boat, sway from a camera crane).

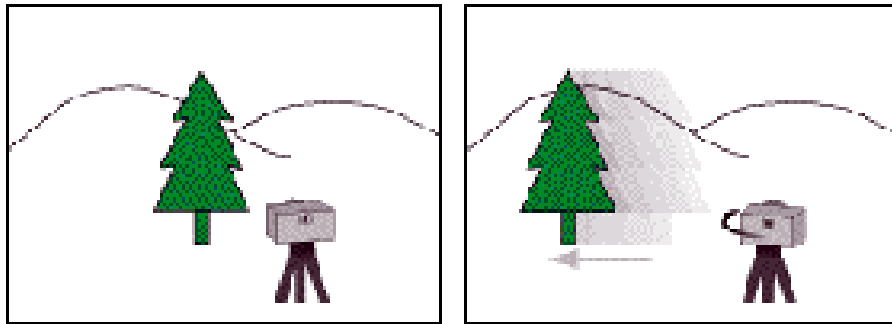
A high bandwidth system will STOP low and high frequency, or a large range of base motion, from getting to the camera (i.e. the vibration of a helicopter, the rapid shakes and bumps from a camera car, as well as the rocking and rolling of a boat and sway of a camera crane).



The spinning gyro will hold its position interdependent of the base motion.

To remove the “Angular Base Motion” is the most important job of the stabilized system. Angular disturbances are vibrations that are angular to the axis of the film plane. If the camera has an angular disturbance of  $1^\circ$  then the line of sight of the lens will sweep a large area in the camera frame, as the focal point of the lens may be a mile away and that  $1^\circ$  multiplied by a mile is a huge sweep in the camera frame.

The “Linear Base Motion”, also called parallax error, is actually of little consequence to the Director of Photography and current world technology cannot completely remove it.



Parallax error will cause the foreground to move in frame while the background is stationary. Linear disturbances are vibrations that are perpendicular to the film plane, side-to-side and straight up and down movements.

If the linear disturbance is 0.1 of an inch at the film plane then at the line of sight a mile away the lens will move only 0.1 of an inch. This phenomenon is not noticeable at the long end of the lens and only slightly negligible with short lenses when the subject is very close to the focal plane.

Every stabilized system, active or passive, whether high or low bandwidth design, eliminates only the angular or rotational movements and the linear disturbance (straight up and down or sideways) can only be minimized by a cushion between the base connection of the head/mount and its support. These are the springs or coils that are used at the connection between the standard Mitchell mounting and the stabilized head/mount. In some cases the cushion is built into the stabilized system.

Other terms that are used to describe a stabilization system are “active” or “passive” systems of stabilization. Active systems are ones that utilize DC power, sensors, electronics and motors attached to gimbal rings to correct a “base” motion from affecting the camera. Examples of “active systems” range from the Nettmann System’s Stab-C to the Geo Film’s Libra Head. Passive systems are purely mechanical and rely on the “balanced beam” phenomena. The ‘beam’ will resist a “base” motion from affecting the camera positioned at the end of it because of the inherent inertia of the balanced beam. Examples of passive systems are Tyler Middle and Major Mount, Advanced Camera Gyromaster and Steadicam.

# GYRO-STABILIZED SYSTEMS CURRENTLY AVAILABLE

---

To assist production in choosing the correct system for the type of application it necessitates, here is a comprehensive guide to format the industry standards.

The categories below are listed in order:

- Range of vibration bandwidth that the system can eliminate
- The quality of the stabilization design
- The range of cameras that can be used

## TYPE 'A' (Fully Servoed Electronic Stabilization)

- High bandwidth
- Open or Closed architecture
- Steerable roll 'Dutch'
- Fully servoed - electronic gyroscopic technology

These systems are of a high bandwidth design and rely on complex electronic sensors, actuators and motors to correct the base motion from affecting the camera. They will remove almost all of the angular disturbances from the shot. All of the (A) systems utilize electronic control servo loops, are extremely fast acting (high bandwidth) and very adaptable to various camera/lens payloads. These systems can be used extensively on camera car, crane, or suspended cable systems as well as aerial helicopter work. These systems can stabilize almost any camera and lens combination imaginable, as they are open architecture i.e., the camera is not part of the system. The open architecture A systems are stabilizing platforms only. They will stabilize any film or video camera provided the center of gravity of the camera can be positioned inline with the inner gimbal axis. This is a very nice feature as any standard production camera or lens can be utilized to the delight of the DP or visual effects dept. These systems have a steerable roll feature where the roll axis can actually dutch while still stabilizing or can just keep the horizon level.

Examples of the (A) 5-Axis types of systems currently available are:



**Super-G**  
by Nettmann Systems  
International



**Stab-C Classic**  
by Nettmann Systems  
International



**Mini-C**  
by Nettmann Systems  
International

Examples of the (A) 5-Axis types of systems currently available (contd):



**Wescam XR**  
by Pictorvision



**Eclipse**  
by Pictorvision



**Cineflex**  
by Axsys-General Dynamics



**Stab-C Compact**  
by Nettmann Systems  
International



**Ultramedia HD**  
by Flir

#### TYPE 'A-1' (Helicopter Ball Mounts)

- High bandwidth
- Closed architecture; limited camera selection
- Horizon leveling - roll 'dutch' not steerable
- Electro-mechanical gyroscopic technology

These systems are all remote controlled gyroscopic assisted stabilizing platforms. They utilize a series of spinning fly wheels and electronics to dampen the angular disturbances. They are mostly used for helicopter work but can also be used for camera car, crane, or suspended cable systems. The A-1 systems do not have steerability of the roll (dutch) axis, only horizon leveling. These systems as well as the (A), will eliminate almost all of the angular disturbances. The drawback is that the (A-1) systems are closed architecture systems. The DP can only utilize the offered one or two cameras and lens combinations, normally a Mitchell R35 camera and a 10:1 zoom lens.

(A-1) types of systems currently available are:



**Wescam 35mm**  
by Wescam L3



**Spacecam**  
by Spacecam Systems

Spacecam can also fit an IMAX camera in place of the Mitchell camera wescam spacecam Wescam 35mm

#### TYPE 'B' (Electronically Stabilized Heads)

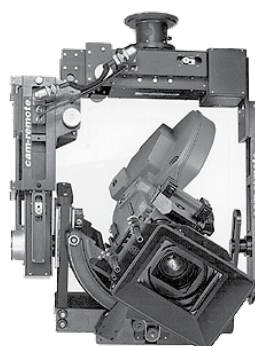
- Low bandwidth
- Open architecture
- Servoed electronic gyroscopic technology

These systems are of a low bandwidth design and rely on sensors, actuators and motors to correct the base motion from getting to the camera. They will remove a good percentage of the low frequency angular disturbances from the shot, but the high frequency jitter and shake will still get through to the lens. All of these systems are currently used for ground based applications. All of the (B) systems utilize electronic control servo loops, and are adaptable to various camera/lens payloads as most are based on the typical remote head design. The camera is not integrated into the stabilization system, as in the (A-1) category, or the closed architecture systems of the (A) category.

(B) Types of 3-Axis systems currently available are:



**Libra head III**  
by Geo Film works



**Cam-Remote SAS**  
by Nettmann Systems  
International



**Mini-Mote SAS**  
by Nettmann Systems  
International



**Flight head**  
by Filmotechnic  
and the Filmotechic Ukrainian  
offshoots  
**Chapman G3**  
by Chapman and  
**The Lev-Head**  
by Ultimate Arm



**Scorpio Head**  
by Service Vision

#### TYPE 'C' (Helicopter side door mounts)

- Passive Stabilization (High inherent inertia)
- Open architecture

Stabilization qualities enhanced by placement of Kenyon gyros onto mount Helicopter mounts are based on the principle of a balanced beam that has its gimbal point (center of gravity) behind the operator's head. The gimbal point is the exact balance point of the roll, pitch and yaw. At the front of the balanced beam is the camera and camera control. At the back of the beam are the counterweights and batteries. The camera has an additional pan and tilt axis (yaw and pitch axis). These are balanced in their own right about the sub camera tilt axis of the balanced beam. This balanced beam in itself has a certain amount of inertia and will resist minimal angular disturbances coming up the gimbal mounting frame. However, in order to achieve a further degree of stabilization, Kenyon gyro modules are added.

The Kenyon gyro module is an off-the-shelf motorized flywheel in a cage with one degree of freedom. When the spinning masses (flywheels) within the Kenyon gyro housing, are activated, they add an increased inertia (synthetic) to the overall system, which improves the mount's ability to absorb the base angular disturbances from reaching the camera.

These helicopter mounts with or without Kenyon gyros, can work quite well if: the weather conditions are perfect; the helicopter has the minimum of low frequency vibration (blades have been ‘tracked’ correctly); and you have a “qualified movie pilot” in control of the ship. An operator can achieve good stability for medium focal length lenses with short duration shots at the longer end of the lens.

The drawbacks of (C) systems are that the operator’s physical strength is needed to position the camera while they are hanging out the side door of the helicopter. It is hard for the operator to maneuver the camera’s line of site when they are following a subject. The Kenyon gyros will resist their camera positioning, as the gyro will consider it part of the angular base motion. Because of this interaction, the helicopter pilot must undertake most of the camera positioning; the operator will just point the camera at the subject, relying on the pilot for keeping the subject in frame.

(C) Types of systems currently available are:



**Middle mount II**  
by Tyler Camera Systems



**Gyromaster**  
by Advanced Camera  
Continental Mount



**Major mount**  
by Tyler Camera Systems

#### TYPE ‘C-1’ (Horizontally balanced gimbal rings)

- Passive Stabilization (Low inherent inertia)
- Open architecture

Stabilization qualities enhanced by additional gravity seeking pendulous mass. These types of systems use a pendulous swinging mass assisted by motors to reduce angular disturbances. Originally designed to remove the extremely low frequency angular disturbances of the ocean’s rolling motion, they are now being used to stabilize cameras and remote heads in certain applications.

(C-1) types of systems currently available are:



**Hydro-Gyro and Perfect Horizon**  
by Motion Picture Marine



**Gyro-Pro**  
by Peace River Studios



TYPE 'D' (Horizon Lock Only systems)

- Single axis stabilization
- Closed architecture; limited camera selection.

These systems are simple three axis camera positioners with only the roll axis horizon stabilized. When the horizon compensation is turned on, the system will only hold the horizon in frame. This helps maintain the horizon when the head is mounted on a crane or vehicle. No other axis is gyro stabilized thereby allowing the full range of base motions to get to the camera and lens.

(D) Types of systems currently available are:



Rollvision  
by Coptervision



## Film Industry Gyro Stabilization Systems Categories

Categories	Description	Bandwidth		Remotely Operated	Max length of lens for complete stabilization	Open Architecture (many camera selections)	Systems Available
		High	Low				
A	Fully Servoed Electronic Stabilization Heads			YES	Long Lenses	YES	SUPER-G, STAB-C, STAB-C COMPACT & MINI-C BY NETTMANN SYSTEMS INTL WESCAM XR BY WESCAM SCULPES BY PETERBOROUGH CINEFLEX BY AEROS-BENTON DYNAMICS ULTRAMEDIA HD BY ILL
A-1	Helicopter Ball Mounts			YES	Long Lenses	NO	WESCAM 35MM BY WESCAM SPACECAM BY SPACECAM SYSTEMS
B	Electronically Stabilized Heads			YES	Medium	YES	LIBRA HEAD III BY GEO FILMS CAM-REMOTE SAS & MINI-MOTE SAS BY NETTMANN SYSTEMS INTL FLIGHTHEAD BY FILMORECHNIQUE
C	Helicopter Side Door Mounts			No (Manually Operated)	Medium	YES	MIDDLE & MAJOR MOUNT BY TYLER SYSTEMS GYROMASTER BY ADVANCED CAMERA
C-1	Stabilized Balancing Gimbals			YES	Medium	YES	HYDRO GYRO BY MOTION PICTURE MARINE GYRO-PRO BY PEACE RIVER STUDIOS
D	Horizon Lock Only			YES	Short	NO	ROLLVISION BY COPTERVISION

# ABOUT Nettmann Systems

Nettmann Systems International is a family-owned, multi-award winning, high-tech development company specializing in unique cinematography equipment for the demanding environment of live broadcast and motion picture production.

Nettmann Systems International provides cinematographers, directors and producers the exceptional tools for the most sophisticated and demanding shots.

## CUTTING EDGE TECHNOLOGY

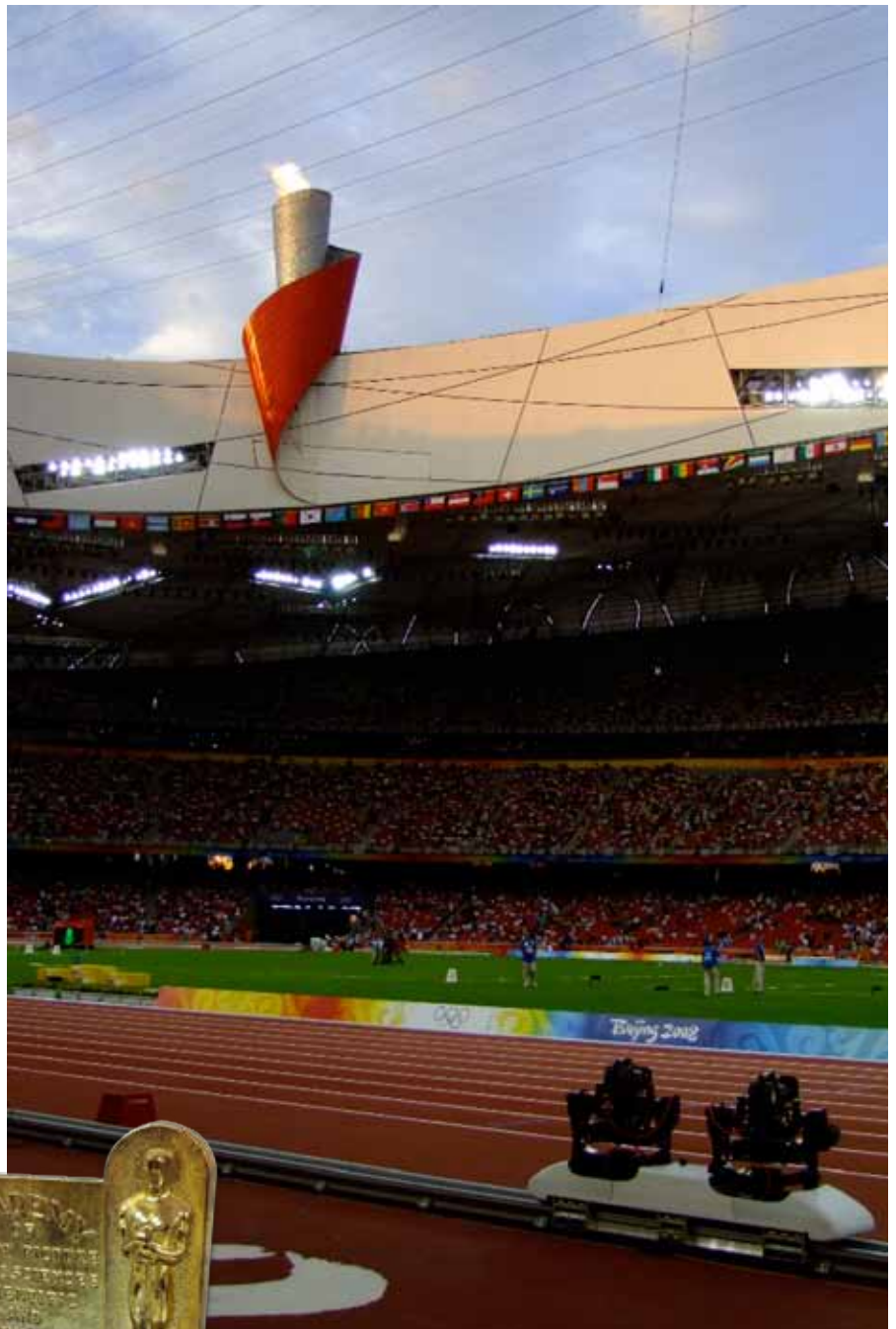
We pride ourselves on providing our clients the latest cutting-edge technology, coupled with innovative design and incredibly high standards. The result: a faithful client base that has stood by our products for years, AND the awards to go with it.

## MADE IN THE USA

All of our products are proudly made in the U.S.A. Each product is built by hand and thoroughly inspected at our facilities located in Los Angeles, CA.

## 40+ YEARS OF INDUSTRY EXPERIENCE

Originally established in 1972.



### GYRO-STABILIZATION

Nettmann Systems specializes in Gyro-Stabilized Remote Heads for the Broadcast and Motion Picture Industries. This technology has also been used in field tests by N.A.S.A for the Mars Landing.



### AERIAL CINEMATOGRAPHY

Nettmann is well known for aerial cinematography, worldwide. As a result, our systems are the product of choice for aerial cinematography in motion pictures.



### REMOTE CAMERA SYSTEMS

Our Remote Camera Heads are used extensively for television broadcast and film. The Cam-Remote, Mini-Mote and Kenworthy Snorkel are just a few of the systems in use.



### CAMERA SUPPORT

Nettmann offers a wide array of camera support equipment. A full list of products is available, with full specifications, at [www.camerasystems.com](http://www.camerasystems.com)

**Why Nettmann Systems?** Nettmann Systems International has over 40 years of experience in the motion picture and broadcasting industry. This, coupled with innovative, award-winning technology puts our equipment ahead of the competition.

Nettmann products are known in the industry to be the “Rolls Royce” of camera support and remote stabilized heads. Built for live broadcast, film production companies, directors and cinematographers who require superior camera support, Nettmann provides aerial cinematography, camera support, sensor positioning systems and gyro-stabilized camera remote heads, all of which offer exceptional image

stabilization for both ground and aerial cinematography.

Unlike our competitors, N.S.'s fully integrated, high-tech systems, provide cinematographers, directors and producers state-of-the-art technology with the tools necessary to address the most sophisticated and demanding shots.



“ It is the ROLLS-ROYCE of Remote Systems. ”  
ERIC VAN HAREN NOMAN; CINEMATOGRAPHER **THE VALLEY OF LIGHT**

## MANAGEMENT TEAM

**E.F. (Bob) Nettmann**  
President & Founder

**Karl Nettmann**  
Operations & Production  
Manager

**Mike Sayovitz**  
Vice-President Engineering

**Ron Spongberg**  
Customer Support &  
Rentals Manager

GYRO-STABILIZATION

AERIAL CINEMATOGRAPHY

REMOTE CAMERA SYSTEMS

CAMERA SUPPORT

ROBOTICS



1026 GRISWOLD AVENUE | SAN FERNANDO, CA 91340  
p:818-365-4286 | WWW.NETTMANNSYSTEMS.COM