Center for Entrepreneurship & Technology
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Technical Brief

The Future of Sportscasting

Engineering Leadership Professional Program

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With every new communications technology there has been interest in using it for live sportscasting. We believe that today’s sports viewers are interested in point-of-view (POV) live content to further immerse themselves in the game by looking through the eyes of an athlete.

This technical brief will review the following market enablers: a growing worldwide sports viewing market, expansion of high-speed internet, wearable cameras with HD streaming technology and disruptions of how consumers view sports content. It will also cover the challenges of integrating POV content into a complete game broadcast (as just one of multiple camera angles), the need to partner with sports organizations and the owner of the broadcast rights, as well as athlete and team privacy concerns.
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INTRODUCTION: THE FUTURE OF SPORTSCASTING

With every new communications technology there has been interest in using it for live sportscasting, as shown in the figure below. We believe that today’s sports viewers are interested in point-of-view (POV) live content to further immerse themselves in the game by looking through the eyes of an athlete.

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<th>1895</th>
<th>1922</th>
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<tr>
<td>1911</td>
<td>1st live telegraph coverage</td>
<td>1st US live radio coverage</td>
<td>1st world live TV coverage</td>
<td>1st sports cable TV channel</td>
</tr>
<tr>
<td>college football</td>
<td>boxing match</td>
<td>Berlin Olympics</td>
<td>ESPN</td>
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I. Timeline of invention dates for key communications technology and its first use for live sports broadcasting.

This technical brief will review the following market enablers: a growing worldwide sports viewing market, expansion of high-speed internet, wearable cameras with HD streaming technology and disruptions in how consumers view sports content. It will also cover the challenges of integrating POV content into a complete game broadcast (as just one of multiple camera angles), the need to partner with sports organizations and the owner of the broadcast rights, as well as athlete and team privacy concerns.
I. TECHNOLOGY LANDSCAPE AND READINESS

1. ACTION CAMERAS

Broadcast Sports Technology, now Broadcast Sports Inc., was an early player in the action sports camera market. They provided the first in-car camera for NASCAR during the Daytona 500 in 1983 and they still install and control the in-car cameras for NASCAR races. BSI has also provided cameras for a variety of sporting events including a "mask-cam" for baseball and a "goal-cam" for hockey. Although their technology has improved significantly since the 1980’s and switched to HD in 2007, it is not easily adaptable to amateur use and is not marketed for the personal wearable market. That is mostly due to limitations with their technology. Only four cameras can be used per system and a maximum of eight systems can run at one time due to the limitations of video management and distribution capabilities—which are managed on-site in four 48-foot trailers loaded with electronic and mechanical gear. (1) (2)

The action camera market is expanding rapidly, primary for personal wearable applications. GoPro is the primary example of wearable point-of-view (POV) video cameras. GoPro hit the market just right with their small size and high-quality, high-resolution package that provides their characteristic wide-angle perspective. From a size standpoint, the 4th-generation GoPro HERO camera is about the size of a matchbox and is capable of capturing 4K video at an incredible 30 fps and for 1080p at 120fps. To put in perspective, that is full HD in 1/4-speed slow motion which is truly very powerful in a device that costs about the same as an entry-level DSLR or compact system camera. With the speed coupled with a lens capable of capturing a 170-degree field of view, the camera is perfect for capturing key action footage in the sporting arena.

![GoPro Hero4 camera](image.jpg)

II. GoPro Hero4 wearable action camera product.

However, the recorded images from action cameras can be jerky depending on the sport and the action and will require post editing. Existing video stabilization methods may not be sufficient for HD professional sportscasting. Technology similar to the mobile app Hyperlapse can be used to provide a smooth POV image. Hyperlapse uses an algorithm that first reconstructs the 3D input camera path then optimizes an alternative camera path that is smooth. Then it generates a smoothed, time-lapse video by rendering, stitching, and blending appropriately selected source frames for each output frame. (3)
Despite the fact that action camera annual shipments are projected to grow 47 percent until 2018, this industry is considered as still in the nascent stage. New competitors are expected since there are no significant barriers to entry. Current competitors include GoPro, Contour, Drift, Panasonic, HTC, Sony, Garmin, iON, Polaroid and First Vision. (4)

As of February 2015, GoPro has a market cap of 5.72B and quarterly revenue growth of 75.4% (year over year). The yearly revenue growth from 2013 to 2014 was 41% with a 35% increase in units shipped to 5.2 million. GoPro introduced new models in 2014 and now offer three products in a price range of $130 to $500. Their gross profit margin was 45% in 2014, an increase from 37% in 2013 due mostly to a decrease in per unit product costs. GoPro has three primary geographical markets (the Americas, Asia Pacific, and Europe, Middle East and Africa) and international sales were just 38% of revenue in 2014. With 5.2 million units shipped in 2014 versus 30 million portable navigation devices in the U.S. and 90 million digital cameras and camcorders, there is opportunity for strong growth for several years. (5)

III. World Wide shipment forecast for action camera market (Futuresource, 2012).

Market forecast company CCS Insight Ltd reports that action cameras are a much-forgotten part of the wearables market. They were a central product in the market's early stages and remained the second-biggest wearables category in 2014. Unlike the traditional consumer camcorder market, action camera growth may remain resilient to the threat of convergence and video-enabled phones due to the specialist functions and
capabilities associated with the devices. (6) Although CCS Insight predicts continued growth in the wearable camera segment boosted by more affordable and capable products, the near universal access to cameras on smartphones will limit sales to the average consumer. (7) Visiongain believes that the wearable camera market will increase at a 23.1% CAGR, reaching a $1 billion in 2019, as shown in the figures below. (8)

![Chart 5.15: Global Wearable Camera Sub-Market Revenue Forecast 2014-2019 ($ bn; AGR %)](chart)

Source: visiongain, 2014

| Table 5.9: Global Wearable Camera Sub-Market Revenue Forecast 2014-2019 ($ billion, AGR %, CAGR %, Cumulative) |
|--------------------------------------------------|---------|---------|---------|---------|---------|---------|-------------------|
| AGR (%)                                          | -       | 14.3    | 23.7    | 22.4    | 0.75    | 1.00    | 33.6%             |
| CAGR(%) 2014-16                                  | 18.9    | 2016-19 | 26.1    |         |         |         |                   |
| CAGR(%) 2014-19                                  |         | 23.2    |         |         |         |         |                   |

Source: visiongain, 2014

IV. Revenue forecast for wearable camera market. (8)

To enable further growth, GoPro is expanding their business model beyond just the hardware and its networking capabilities. At the 2015 Consumer Electronics Show, CEO Nick Woodman stated he envisions the company as making a transition from hardware to a big media company, citing the success of the GoPro Channel as part of the company’s future direction. The GoPro Channel is already distributed through media platforms like the Xbox One and Xbox 360 entertainment systems, in-flight entertainment on Virgin America, and social channels including YouTube, Facebook, Twitter, Instagram, Vimeo,
Pinterest and GoPro.com/Channels. At CES, GoPro also announced a partnership with LG, which will feature the GoPro Channel on their smart TVs. Woodman also hinted at the company’s future plans to put a GoPro camera on every player in professional sports, enabling the viewer at home to choose their own second or third screen experience while watching the game on the main feed or channel. (9)

However, GoPro has competition in the transition to the media business as well. VholdR, a market leader with the ContourHD wearable camcorders, has a one-year partnership with the Summer and Winter X Games in 2015. In addition to a partnership with X Games, VholdR has also teamed up with Ducati North America and the Spider Grips/Ducati Team to use the ContourHD as the “Official Team Helmet Cam.” (10)

2. INTEGRATION OF ACTION CAMERAS WITH ATHLETIC EQUIPMENT
The helmet-mounted camera idea has been around for many years, as can be seen in US patent 6819354 B1 for “Completely integrated helmet camera” filed in June 2000.

As seen in the depiction and as described in the abstract: “A camera unit is mountable to the helmet including a single-chip image sensor, such as a color complementary metal oxide semiconductor (CMOS) image sensor, and includes an attaching unit that is structured to allow the camera unit to be attached to an existing structure of the helmet, such as to a face mask of a helmet. The camera unit further includes a transmit unit to allow transmission of a signal representative of captured images and a receive unit to receive control signals to control parameters associated with the camera unit. The control signals can be sent from a remote unit, thereby allowing the remote unit to control parameters of the camera unit, such as exposure, gain, white balance, color saturation, brightness, or hue. The camera unit can be of a small size and weight, and can be completely integrated on a single-chip, thereby minimizing intrusiveness to the helmet wearer.” (11)

While there are multiple claims, the key claims are:
• A camera mounted to a helmet
• Wireless transmission of data
• Method of using a system on a chip / processor to control the camera wirelessly
• CMOS or complementary metal oxide sensor
• To provide data formatted specific to sports broadcasting
Since 2000 the number of wearable or integration-capable helmet cameras or portable digital content type patents has happened but what is most notable is that it has accelerated noticeably since 2010 indicating that the market is indeed building an ecosystem around the idea of wearable devices for enhancing sporting viewing / broadcasting.

As an example, the GoPro cameras have no screen and no way of checking your film footage quality on the camera itself. It is now fairly intuitive to connect any GoPro camera to a smart device via Wi-Fi to check the actual live and recorded footage. Other customer high demand features include: Bluetooth support, not just Wi-Fi, and the ability to tag your best footage as you shoot it. These key aspects make it likely that embedding their camera in the protective housing of a helmet seem all the more likely. The Hero4 camera weighs just 3.1 oz. up to 5.4 oz. when including the housing and battery. The better lifetime, with WiFi streaming enabled, ranges from 55 to 100 minutes based on usage. The question remains whether a mounted camera in an athlete’s helmet or clothing can create problems for players and their performance.

Items that need vetting out from a reliability and durability standpoint include:

1) Can a GoPro camera handle the beating and wear and tear typical of professional sports, or is there more evolution in design needed for the emerging class of sport vision cameras?
2) Athletes must be comfortable with the camera. Therefore integration of the camera respective of the athlete’s personal space will drive easily mounted self contained helmet cams like the HKVI U. (12)
3) Batteries: For the professional likely molding the cameras into helmets with inductively charged, or longer living batteries, or fast swapping of charging units may be a requirement.

Another Spanish startup company in this market space is First VISION. They integrate wearable camera technology, and other health monitoring technology, into sports jerseys. They use flex circuits with integrated sensors to measure heart rate, acceleration, speed and more. The circuits are integrated with Intel’s new Edison chip as the data collector, processor and transmitter. It is a single-core or dual-core microprocessor that comes WiFi capable.

VI. Photographs of First Vision sports jersey with wearable action camera.
The success of integrated POV footage will ultimately depend on two things. First, the response of audiences, and second, the willingness of players to use them. If the audience responds well to the POV footage and demands it, the league will surely want to encourage it as that would open another valuable ad revenue stream for the league. But for in-game usage, the cameras need to be mounted in a way so that they are not distracting or a danger to the athletes using them. More beta testing is sure to follow with reliability and shake tests in the works to prove out the packaging. This shows that POV video is providing a tremendous inflection point for companies interested in participating in the first person perspective broadcasting market. (13)

Considering the positive response thus far with the NHL ref head cams, the NHL All-star game, and the inroads that companies like First V1sion are making with padded vests with flexible circuitry design capable of measuring heart rate and other biometrics while at the same time providing a first person camera perspective, it would not be surprising to see someone like First V2sion or GoPro with a camera embedded in helmets in the NHL or NFL in the next five to ten years. If that happens with GoPro, then they can rightfully call itself a media company.

3. WIRELESS HD VIDEO STREAMING
The market for HD live streaming technology is mature. Some companies that are showing leadership in the merging of action camera videos with live streaming technology are Vislink, Livestream, NTC and Sony.

- Livestream offers a mobile app for live-streaming direct from GoPro cameras. However this stream is low-quality since GoPro only provides a low-res stream through Wi-Fi. (14)
- Livestream product that performs much the same way that Vislink does for live-streaming camera feeds. (15)
- HTC provides livestream software to YouTube.
- Sony Ustream connects to local Wi-Fi and streams.

The 2015 X Games was the first time that GoPro cameras transmitted live video to be immediately integrated into ESPN’s telecast. GoPro worked with Vislink to develop an RF transmitter small enough to be mounted in the unique locations that GoPro cameras are capable of shooting in. A tether unit links the camera and the transmitter and is attached to the helmet of athletes willing to wear it. Although GoPro declined to address the specific amount of latency, the fact that ESPN is taking the camera live during its telecast is a ringing endorsement of a potentially legitimate live-broadcast tool. GoPro will deploy the systems at selected AMA Monster Energy Supercross events this year. (16)

In another first, GoPro formed a new partnership with the National Hockey League (NHL) and the NHL Players' Association (NHLPA) to provide real-time content in the live broadcast of the NHL All-Star Weekend in January 2015. GoPro, in collaboration with Vislink, enabled GoPro HERO4 helmet-mounted cameras with a professional, live, HD wireless broadcast capabilities. (17) (18) (19)
II. NEW VALUE CHAINS

The main relationships in the ecosystem of POV sportscasting are 1) suppliers of technology such as action cameras, wearable cameras integrated with athletic equipment and WiFi connected streaming equipment; 2) broadcast partners that have existing relationships with sports channels and professional athletic leagues as well as athletes themselves that wear the system for live-streaming; and 3) the end consumer who will be watching the POV video.

4. SPORTS BROADCAST MARKET

To break into the major American sports leagues, partnership with the sports leagues, player’s leagues and broadcasting networks are required.

Media rights are projected to continue growing at the highest rate among the four segments; a compound annual rate of 9.1 percent, from an estimated $12.5 billion in 2013 to a projected $19.3 billion in 2018. The segment continues to increase in size as the industry works through the current deal cycle and additional sports properties realize the higher valuation of sports content with the runoff of prior generation deals. These new multi-year deals, as with others negotiated over the past several years, reflect the popularity of sports programming with consumers and advertisers (e.g. strong broadcast ratings) and the broader role of its live broadcasts in the overall model of the network and pay-TV segments. The relative size of national rights deals mean the major pro leagues, athletic conferences and other sanctioning bodies will continue to drive industry-wide growth, but similar upside being realized in the current cycle of expiring deals for local TV rights in MLB, NBA and NHL is also contributing to the overall trend (more than 40 percent expire over the next five years). RSN carriage issues in select local markets appear at the moment to be more situational than indicative of change in consumer demand for sports content; yet these cases highlight the importance of pricing and timing in this new generation model for local broadcast rights. The projected pace of growth for
the segment has increased from last year’s edition, primarily in recognition of a more optimistic outlook for rights owners’ ability to carve out or reserve inventory from existing rights deals and further monetize this inventory during the period under new deals or through in-house ventures. The industry is also well-positioned, given its broadcast ratings and in-demand digital assets, to mitigate potential future downside risk related to market penetration of traditional pay-TV and/or realize further growth going forward as consumers and advertisers migrate toward Internet-connected devices and ’second-screen’ activity.

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<tr>
<td><strong>Total</strong></td>
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<td>3.5%</td>
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VIII. Revenue forecast for North American sports market by segment. It shows a 9.1% CAGR for media rights from 2014 to 2018. (20)

Media rights is by far the fastest growing segment in sports market. Overall North America sports market growth is projected at 4.5% CAGR, from $56.9B in 2013 to $70.7B in 2018. The media rights segment projected to grow at 9.1% CAGR, from $12.5B in 2013 to $19.3B in 2018. (20) More than 40% sports media contracts expire over next 5 years which may fuel creative expansion of this growing market.

Team level results are inherently subject to greater variability than the wider industry-wide outlook. Local markets vary in size and strength, teams are at varying points in their respective ownership and performance cycles, and gate receipts at the team level are a dynamic business where change is constant among the key variables impacting ticket demand. Variable and dynamic pricing models and fan loyalty points programs continue to improve the fundamentals underlying the gate revenues segment, including higher conversion and retention rates, as well as drive higher yields, create volume in down years, and incentivize advance purchases. Yet, while variable pricing is now common across the major pro leagues, including ten early adopters in the NFL, the adoption of dynamic pricing models has plateaued the past two years except within MLB, the league with typically the highest single game ticket inventory.
The previous data is for the North American market, but global sports media revenue is growing as well, as shown below for worldwide and geographic region segments.

**IX. Global revenue from 2006 to 2015 for sports media rights.** (21)
X. Global revenue from sports media rights by geographic regions, 2009 to 2013. (22)

 Athletes themselves are a partner for POV live-streaming broadcasts. Along with the shift to more corporate backers, Olympic snowboarder Elena Hight noted how her pay structure has taken a decidedly 21st-century turn. "Social media presence is very much tied to value nowadays," said Hight, whose contracts with GoPro and other sponsors come with specific expectations for sharing and tagging photos and videos. "It's not just coverage in magazines and on TV at high-profile contests that matter anymore." (23)

The development of in-car cameras with NASCAR is regarded as one of the more significant advances in televised coverage of sports. In 2011, ESPN partnered with NASCAR to use the onboard camera views in its NASCAR Sprint Cup telecasts, allowing viewers to watch a crash replay and see both the driver inside the car and what he was seeing. Like everything else in NASCAR, the on-board cameras are sponsored. Usually, the car's sponsor will buy an advertising package from the broadcaster that includes the in-car cameras. In 2007, the satellite television provider DirectTV signed deals with NASCAR to take advantage of the relationship between fans, drivers and the in-car cameras. DirectTV offered a NASCAR “Hot Pass” package with HD images from the in-car cameras and dedicated audio channels for selected drivers. It was a pay-per-view service dedicated to five different drivers on a rotating basis. The channel originally cost fans $10 per Sprint Cup Series race and included exclusive commentary. The pay-per-view service was canceled after the 2008 season but revived before the 2009 season as a dramatically overhauled but free service. The free service and the sponsorship of NASCAR in entirety was canceled in 2013. They cited lack of interest in the product compared to the cost of production as the primary reason for cancellation. (24)
NASCAR.COM, managed by Turner Sports, is one of the top three sports leagues sites on the Internet. In 2013, NASCAR started offering a RaceView mobile app providing live timing data streamed to your device, plus radio chatter and in-car camera angles, originally for $25 (now free to Sprint customers). If you go to the race in person, you can use a handheld device from a company called FanVision to get in-car views from any of about a dozen cars plus radio chatter and timing data. (25) (26)

In 2015, NASCAR reached a 10-year media partnership with FOX Sports, to provide access to the digital video complement to the race broadcast for the entire 2015 NASCAR Sprint Cup Series season through their RaceBuddy platform. (27) (28)

The GoPro partnership with the National Hockey League (NHL) and the NHL Players' Association (NHLPA) capitalized on the recent announcement of GoPro's Professional Broadcast Solution, in collaboration with Vislink. Under the agreement, NHL will be using GoPro devices to make available to hockey fans new perspectives that were not previously seen. The talents of the game’s top players can then be shown in both national and regional broadcasts, as well as be shown through NHLPA, NHL, and GoPro’s digital and social media accounts. However, the deal does not specifically require players to don the wearable camera while on play to ensure safety and comfort. The new deal points to a new, broader market, although GoPro have not yet announced if there are any pending agreements with other major sports leagues. GoPro is soliciting further partnerships in a closed beta phase via their website. (29) (30)

5. DISRUPTIONS TO VALUE CHAIN
On March 19, 2015, Sony introduced an internet television service that streams more than 50 channels into homes via its PlayStation game consoles. Little more than a day earlier, Apple announced that it is building a similar service for use with its Apple TV set-top boxes. These big-name technology companies are following several others in the push to stream television over the net—without requiring ties to traditional cable TV services.
Today, the big difference between cable TV and internet TV is live programming. “Sports is one of those last things that makes people still want to watch TV in a linear fashion,” says Tony Emerson, a Microsoft managing director who works closely with hundreds of the world’s media and cable TV companies. Unlike almost everything else on TV, sports happen in the moment.

Internet TV makes it easier to view programming on any device and it gives consumers more freedom to watch programming when you want to watch it. But many wouldn’t dream of cutting their cable cords because they would lose live games from the NFL, Major League Baseball, the NBA, the NCAA, and other popular sports organizations.

“Live events—sports and others, but mainly sports—are certainly an impediment to cord cutting,” says Stephen Beck, the founder of a consulting firm called cg42, which has closely studied the move to internet television over the last few years.

This move all started with a service called Sling TV. Sling was built by satellite TV company Dish but it sends a TV signals over the internet—and its collection of channels includes ESPN. Sony’s new service doesn’t offer ESPN or its sister network, ABC but it does offer all the other big American sports broadcasters and you don’t need a cable TV subscription to use it.

The 2014 NCAA Basketball “March Madness” playoffs surpassed 51M live videos streams, up by 40% over 2013, according to Turner Sports data. Similarly, during the 2014 FIFA soccer World Cup ESPN’s live streaming site logged 30M hours of direct viewing. For comparison, the 2012 Summer Olympics generated 13.6M hours.

6. SPORTS VIEWING TRENDS
The individual sports viewer is the primary consumer. The end consumer is demanding more live content over the internet as described above. They are also seeking more customization in online media packages.

XII. Average viewing audience for major sporting events in 2014.
XIII. Consumer survey response showing which programming channels are most likely to be purchased as part of a custom package. Sports is the third highest category for customization. (20)

Sports associations and teams are also consumers of the new technology. Today, the NHL and several NFL football teams have begun integrating GoPro cameras to record footage within their practice sessions to help with enhancing training, developing timing/plays, and studying run routes field of views. Coaches use the knowledge provided by the video to gain essential perspective as seen by running backs, quarterbacks and other key players.
CONCLUSION

In summary, the technology to support live-streaming POV sportscasting is available: from wearable action cameras, to integrated athletic equipment like helmets and jerseys, and HD live-streaming data delivery systems. There is a large global sports-viewing market in which the desire for customization is becoming more common as video delivery over the internet becomes more mainstream.

The ecosystem is in place to support a viable market but the monetization of the business model for professional sports POV video is still maturing.
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**BIOGRAPHIES**

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