

The Future is Mobile News & HD-ENG: Handheld Camcorders join Shoulder-mounts for "family flexibility" and cost savings



The 2012 Priority Issues for TV Stations: Winning the Audience Race in a Smart (Connected) TV World Leadership in delivering the TV News to Mobile Platforms Expanding Mobile Newsgathering in HD... cost effectively



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EXECUTIVE OVERVIEW

More than 500 U.S. TV Stations are now broadcasting HD News

Local, national, and worldwide television news must have the capability to go live on the air with late-breaking news, with live pictures from the remote site, and, when appropriate, live interviews between the news anchors and the field talent, and between the field talent and the news subjects. Whether from ENG helicopter, ENG van, handheld or shoulder-carried, instant wired or wireless delivery of news to the TV station with true HD quality on-air is an absolute necessity for local TV news market leadership in 2012.



HD News Set at WOIO 19 Action News, a Raycom station and CBS affiliate, Cleveland, OH (Nielsen DMA #18) equipped with JVC ProHD camcorders mounted in highly cost effective studio configuration. Six years ago, we counted just 30-some TV stations around the US with significant HD local news origination, largely accomplished by converting their SD news set to HD, but with little meaningful "breaking news" HD ENG on the air. Then, with perhaps only one TV station in each market doing HD studio news, there was a substantial competitive edge back then going to a HD studio news set at the local level, even without HD ENG on-air capability. By 2010, the HD News and HD ENG move was well underway, helped in no small measure by JVC's cost effective ProHD camcorders and HD studio camera configurations.

Now, at NAB-2012, <u>more than 500 TV stations around the US are doing HD news</u>, many from newly built HD news set, and equipped with HD studio cameras, switchers and support equipment at significant investment levels at each TV station. However, many TV stations are still not capable of doing live (or near live) HD ENG, and some "early HD News adopters" TV stations are handicapped by using older, expensive HD studio, editing and ENG facilities where outdated signal/work flow may compromise local competitive position.

HD studio news by itself, without live/near-live HD ENG, is no longer a major competitive edge in many Top-100 Markets. <u>The competitive necessity is now LIVE & Near-Live HD-ENG</u>.



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TV Households & HDTV Penetration in 2012

The Nielsen Company estimates that there are only 114.7 million TV households in the U.S. in 2012, which is <u>down from 115.9 million in 2011</u>, while total number of U.S. households keep on increasing year-over-year. TV households mean any household with a minimum of one (1) TV set being watched at least occasionally, whether old NTSC or new HD flat screen.



The U.S. Census Bureau states that Total Households 2010 = 117,538,000. Projecting this to 2012 increasing by 1% per year (poor economy causes less growth in households as young people must stay with parents longer for economic reasons, or may share household with other young people) over two (2) years = nearly 120,000,000. Using round number 115 million TV households for 2012, this is <u>only 96%</u> of all households.

Your OTA Audience . . .

Applying the above TV household numbers to the average DMA, only about 10% of the local households rely exclusively on OTA (over-the-air) DTV reception to (potentially tune you in and) enjoy your newscasts, while the other 90% of TV households are subscribers of cable/satellite /telco TV service (MVPDs = Multichannel Video Programming Distributors). But bear in mind that, of the 90% subscribing to MVPD service, many TV households have multiple TV sets where the primary ones (i.e. living/family room-based) are MVPD connected while the smaller secondary ones may be supplied OTA and/or internet connected through "Roku-type boxes" and "Netflix/Hulu/VUDU capable" internet-connected Blu-ray players. As these viewers are





likely to be "secondary audience", and as audience-ratings are mostly about who's watching on the primary TV sets, your MVPD-connected audience is the important one. (But don't tell that to the FCC in this era of "spectrum grab".)

<u>This analysis makes expanded local news coverage even more important</u>, as the viewers watching the primary HDTV sets in the home is the audience advertisers want to reach, which would be the target audience responsive to expanded local newscasts. Also bear in mind that 20% of all TV households are still watching on old analog NTSC TV sets, which require either subscribing to MVPD with DTV-converted-to-NTSC channel band, OR free OTA TV through an OTA set-top-box, OR an MVPD set-top-box, with NTSC signal out to feed that old analog TV.

The 2012 Priority Issues for TV Stations

- A. Winning the local Audience Race in a Smart (Connected) TV World
- B. Local leadership in delivering the TV News to Mobile Platforms
- C. Expanding Mobile Newsgathering in HD . . . cost effectively
 - ... to achieve the above two issues.

The Hot Topics of Mobile Newsgathering in 2012:

Handheld HD-ENG camcorders with Wi-Fi and FTP, and shoulder-mount HD-ENG camcorders with 4G/LTE camera-back, for additional backhaul solutions.



We believe that this ProHD 2012 Report will assist you in your understanding of these major issues. <u>Please read on</u>.





Local TV News & Content are more essential than ever

Expanding Local HD Newscasts (including/adding/streamlining HD ENG) makes more sense than ever before, as cable/satellite/telco TV (MVPDs) and internet OTT TV program choices and hours increase. Bottom line for a TV station is local ad sales, which success is largely related to the number of eyeballs watching the TV station. The problem is that, as more and more (reruns and VOD) program channels become available over MVPDs and OTT TV over broadband internet, with most new OTT streaming services offering thousands of movies and reruns of both newer and older TV series, the TV station's ability to compete by offering "just another syndication program" is and will continue to diminish. As a matter of fact, the large majority of TV programs available to a MVPD household at any given time are reruns, including newer programs being rerun over and over again for days, weeks and even months. It's becoming increasingly difficult for a local TV station to compete in the daytime syndication programming game without a substantial and loyal audience following resulting from daily local newscast. And the newscasts really need to be in HD, both studio and ENG, to have maximum appeal and sticking power.

It is not surprising that we are seeing a substantial growth in local newscasts all across the country, in terms of the number of hours per day of local news broadcasts at each station. The direct competition for a live local newscast is the limited number of TV stations (perhaps 2, 3 or 4) doing live newscasts at the same time, while the direct competition for a Dukes of Hazard rerun may be a hundred or more different (non-news) programs available over cable in the same time slot. You have full local control and flexibility over the local newscast, while you have little or no control over a syndicated rerun once contracted for. If the time slot makes sense for local news, you may wish to think twice before you sign that 3-year syndication deal!

The RTDNA/Hofstra (mid-2011 released) survey of TV stations found that nearly 1,000 (full power) TV stations in the U.S. are doing daily newscasts, of which about 750 <u>produce and air</u> their own while nearly 250 air news programs produced by others. The average number of hours of newscasts on-the-air is between 5 and 6 per day. The trend for the past two years is for daily newscast hours to increase for each TV station doing news, <u>thus it is</u> <u>clearly a local competitive advantage to produce and air</u> <u>local news in HD</u>.







RTDNA/Hofstra found that TV stations with daily newscasts in DMA 26-100 averaged more than 6 hours of newscasts per day, more than the average for DMA 1-25. DMA 26-100 comprises 75 markets, from Indianapolis (DMA 26) to Davenport (DMA 100), containing in excess of 700 TV stations with nearly 400 of those being "newscast stations" (including O&Os) and the large majority owned and operated by the top 25 Group TV Station Owners as Big 4 affiliates. Excluding Big 4 Network O&Os, the top 25 Group TV Station Owners own and operate more than 550 TV stations across the U.S.

So, what may be behind the whopping 6+ hours daily average in DMA 26-100?

- Reruns and syndication are becoming less competitive for TV stations as more and more relatively new TV programs become available to the TV household via MVPD and OTT/Internet, resulting in ratings deterioration for TV stations relying excessively on reruns and "bland" syndication.
- Local TV newscasts only compete with other TV news outlets in the same market in the same time slot, for those eyeballs wishing to watch local news and content. The TV station retains full local control and preserves options in the shorter term. The TV station takes on 2 or 3 (known) newscast competitors rather than a 50 or more rerun and syndication choices available over MVPD/OTT (which are unknown entities).
- It is relatively easy to expand live newscast hours when the TV station is already fully fitted for news operations, with news-set, newsroom and ENG facilities. And the essential transition from SD to HD news/ENG is highly affordable with today's cost effective HD studio cameras, HD ENG camcorders and newsroom file-based editing systems. (See JVC ProHD discussion below)
- Highly cost effective news acquisition and newsroom systems are available to TV stations currently not yet producing their own local news, enabling relatively painless and timely full service newscast entry.





Expanding Local Newscasts . . . reporting on more issues . . . cost effectively

Expanding local newscasts really requires to fill the additional time with a mix of new, fresh material as well as repeating earlier clips. Covering more local issues, whether breaking news or local interest stories, will probably require "more boots on the ground" equipped with HD camcorders and the ability to get the new material back to the newsroom as live HD or at least near live HD. Such expansion of ENG efforts is difficult to financially justify in the traditional costly environment of HD ENG trucks and 2-person crews. Fortunately, the "additional boots on the ground" can be added by implementing new HD ENG technologies in terms of both HD video acquisition and backhaul, in the form of the "VJ team", the "lone ranger" Video Journalist equipped with JVC's new handheld fully professional HD camcorders and 4G/LTE or Wi-Fi wireless backhaul facilities.

> VJ at KNXV-15 ABC-affiliate Phoenix, AZ



The Video Journalist (VJ) . . .

A relative newcomer to the TV station's news team, the job description of this "lone ranger" may be detailed (in part) as follows:

The VJ shall report breaking news stories and cover local issues. Will set up, shoot, write and edit packages to be written clearly and concisely, including live shoots, and anchor and produce news segments as assigned:

- •Report and produce news segments in a timely manner, meeting deadlines
- •Able to gather news stories, using beat sources, contacts and leads
- •General knowledge necessary to cover the community (or neighborhood)
- •Deliver news with energy, confidence, professional appearance and voice quality
- •Able to combine video, audio and graphics in effective presentations

<u>The VJ must be able to work alone in the field</u>, and operate and handle various studio and remote ENG equipment, to lift and carry up to 60 pounds, and to work inside and outside throughout the year subjected to various weather including extreme hot or cold conditions.





VJ's Handheld HD ENG Camcorder . . .

At the heart of the VJ's field equipment package is the HD camcorder, purpose designed for the VJ to deliver high quality HD video and audio under a wide range of shooting conditions, provide ease of use considering the VJ's challenging "lone ranger" assignments, and offer professional features and performance in many areas comparable to the "big brother" shoulder-mount HD ENG camcorder. JVC has just introduced two such purpose designed VJ HD camcorders, the GY-HM600 and GY-HM650, which are detailed later in this Report,



Handheld "VJ" HD ENG Camcorder

One important feature of any VJ camcorder is the ability to swivel/rotate the flip out monitor screen around, so that the monitor is facing the talking head (the "lone ranger" VJ as the reporter) with a clear view of the entire monitor display, to enable the VJ to see him/ herself when on the reporter side of the camcorder. Note that the video picture must flip when the display is rotated 180 degrees to face the reporter, not to be presented upside-down. The flip-out monitor on the 600/650 Series is located above the lens, in front of the handle, to present the best possible view to the reporter.

VJ's HD ENG Backhaul-over-4G/LTE wireless . . . and Wi-Fi

The traditional HD ENG Van with the telescopic microwave tower is still a required tool in most TV station news operations, as high quality HD live coverage from the field may not always be reliably served by the new backhaul-over-4G wireless approaches. Where 10 years ago, a Big-4 network affiliate station in a major market may have had a dozen fully equipped ENG vans staffed by 2-person teams, while, in today's highly cost conscious environment, some of the ENG vans are replaced by "lone ranger" video journalists driving smaller SUVs outfitted with HD camcorders recording to inexpensive consumer memory cards and, when necessary, sending files or live/near live streaming back to the TV station's newsroom by 4G wireless backhaul, accommodated by the wireless broadband providers. The Future is here now. A key decision for the TV station, the news director and the engineering director is what HD camcorders to buy for the video journalists and for the (remaining) fully fitted HD ENG vans, to provide the best possible fit for "backhaul-over-4G wireless" AND on-location over shorter range Wi-Fi, while fully supporting the traditional HD ENG microwave vans. Later herein, this Report explores and concludes an equipment strategy of "family flexibility" as offered by JVC's ProHD products.





Winning the Audience Race in a Smart (Connected) TV World

By 2015, TV Everywhere, OTT TV and Smart TVs will be all over, in connected homes and onthe-road through wireless broadband. But local audiences still need local HD newscasts, including delivery by streaming simulcasts in addition to traditional OTA and MVPDs. A Smart TV (or Connected TV) is a flat screen HDTV set, generally of a larger size suitable for home viewing, connected to a broadband internet service directly, with built-in "PC/ Browsing capabilities" enabling advanced internet searching and the running of media-related applications to find, receive and display a wide selection of television programs and video being streamed over the internet. The Smart TV also provides connectivity to MVPD STBs through HDMI and includes the FCC-mandated DTV over-the-air (OTA) built-in ATSC tuner, and attempts to integrate all TV program sources into one program guide for viewer convenience and flexibility, making lesser known TV programs more competitive as to audience reach, and thus a higher competitive threat to local TV stations.



An existing HDTV set may be <u>upgraded</u> to a Smart TV by acquiring an external Smart TV box (such as a Google TV, Apple TV or other Smart TV upgrade box). See the illustration above. A potential drawback with any external upgrade box is that the upgrade box may not provide ATSC OTA input, thus requiring the OTA antenna to connect directly to the "old, not-so-smart" HDTV set, and thus not be fully integrated in the "smart" program guide/search.





Your Name (Call Letters) here . . .

The real challenge in the emerging world of Smart TVs is to make it easy for the interested and committed viewers to access your TV station's live program whether DTV OTA, MVPD retransmission or the simulcast IPTV Channel, first and foremost at home, but also through mobile television. This is likely to involve the (heavily promoted) availability of a simple app download which icon your committed (and newly attracted) audience will "program" to appear on their Smart TVs' "Home Page" (and on their smartphones and tablets).



Clicking on the icon will rapidly retrieve your TV station's "IPTV/OTT Channel" or perhaps present a simple selection window on the Smart TV screen where OTA, MVPD or IPTV can be selected. An alternate way of quickly retrieving your IPTV Channel may be by saving as favorite channel. You get the drift: As the number of TV/video programs available to the broadband wired home audience increases "exponentially" over the next several years, and as many of these OTT programs may be as easy to access through Smart TVs as clicking on a channel number on a TV/STB remote today, your TV station has everything to gain by initiating a simulcast IPTV Channel with "a single click access".

A number of issues need to be resolved over time, such as possible geographical limits on the streaming of prime time network programs, for the mutual protection of networks and TV stations. No one wants an uncontrolled breakdown of time zone issues, where California OTT viewers may "tune in" the IPTV Channel of a New York TV station and watch a first run prime time episode live 3 hours early. <u>Start with local HD news</u>, weather and traffic, and local content, and possible syndicated shows without time-of-day or geographical limitations. Your IPTV Channel may be essential for your future existence, <u>as leadership in local HD news is "future existence insurance" for a TV station.</u>





Local News/Weather/Traffic is the Mobile Television advantage

Mobile Television competition is brewing, between local TV broadcasters starting to deliver Mobile DTV as a part of their ATSC OTA transmission and the 4G wireless providers (AT&T, Sprint, T-Mobile and Verizon) offering both free and subscription-based television service to display on smartphones and tablets. <u>Mobile television watching is nearly all local, that is 90+% of</u> <u>daily viewers are watching within their own local DMA</u>. Ergo, all those potential local viewers would have some level of interest in local news/weather/traffic extending a large competitive advantage to local TV stations already in the full service news business. The goal is to deliver the TV news already being produced through all "channels" to achieve local news leadership, and thus "longer term existence insurance", for the TV station in this environment of FCC spectrum grab and resulting decreasing OTA audience.



The broadband wireless (delivery) competitors have no local TV news coverage of their own, thus, to compete in the local content arena, they have no real option but to make arrangements with the local TV stations for local 4G/LTE delivery of news/weather/traffic. And the local TV station should support (even initiate discussions) such news delivery, and not necessarily favor their own Mobile DTV. <u>Use all outlets available which make financial sense</u>. And the local TV station with local news leadership stands to make the best deal with the wireless providers.

Expanding Local Newscasts . . . reporting on more issues . . . cost effectively



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Successful Expansion of Local & Hyperlocal TV News requires the "right stuff"

A number of TV Stations around the country are now (and have been) exploring the new local news business model including the operation of "hyperlocal news cells" dividing a large metropolitan area into multiple neighborhoods each represented on the internet by a separate "hyperlocal website" supported by part-time-paid or voluntary local residents as website and video journalists. It seems rather complicated to manage if the TV station is the operational driver, particularly when 10 or 20 or more "news neighborhoods" are established. Perhaps that is the reason why the current trend is to increase the use of "lone ranger" video journalists employed by the TV station, professionally equipped with handheld HD camcorders, laptop/tablet editors and 4G/LTE backhaul support. It seems obvious that the TV news stations competitive edge lies in its expertise in gathering, processing and disseminating video news stories, by OTA, MVPD, broadband and its primary website. The additional burden of producing a dozen or more hyperlocal website versions may indeed not be justified by any increased profitability. In the end, the bottom line is what counts.



<u>We have one recommendation to make</u> to TV Stations entering the hyperlocal TV news gathering game and/or expanding the video journalist staff: Make sure that the handheld HD camcorders provided to the video journalists are fully compatible in work flow and image quality with your primary HD ENG camcorders. ProHD provides "the right stuff" with "family flexibility" through workflow intergration. This will greatly improve the timely delivery of air-ready clips, reduce operational costs and support profitability, and assure professional HD presentations.



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The Top 5 "Executive Reasons" for choosing ProHD for TV News

#1 –ProHD's Affordable Investment

ProHD's combined "win-win" offering of fast workflow, high HD picture quality and most competitive pricing make the investment in ProHD camcorders and studio cameras highly affordable. This is further amplified by reduced operational costs in the use of economical SDHC/SDXC memory cards for media storage and one-stop JVC service and support.

#2 –ProHD's Fast "Go-to-Air-Now" Workflow

JVC's HD-ENG camcorders are designed for fast "Go-to-Air-Now" workflow, whether live or near-live reporting, via flexible backhaul through BAS microwave, 4G/LTE wireless, fiber return or WiFi hotspot. From live (uncompressed) HD-SDI to optional (compressed) ASI outputs, the ProHD camcorders support the fastest possible TV news "go-to-air-now" workflow.

#3 – ProHD's High Professional Picture Quality

JVC's HD-ENG camcorders are designed to achieve higher HD picture quality employing advanced imaging technologies. The ProHD camcorders utilize three precisely offset aligned 1/3-inch progressive scan full HD CCDs and output full resolution in both 720p and 1080i/p. This advanced ProHD capture technology incorporates a new patent-pending Adaptive Pixel

Correlation Technique (APCT) combined with TRIPLEX Offset Technology, delivering exceptional resolving power and sensitivity comparable to cameras with larger image sensors. The new handheld HD-ENG camcorders employ 3xCMOS 12-bit full count HD sensors.



#4 – ProHD's Product Family Flexibility

Commonality and interoperability between camcorder/camera models relying on widely used compressed file formats, economical storage media and operational features support operational efficiencies and interoperability with all major news editing and server platforms.

#5 – JVC's commitment to TV Broadcasters

JVC's product offering in professional HD camcorders primarily addresses TV broadcasters, providing highly cost effective TV news acquisition tools. JVC invites TV broadcasters to join their <u>"win-win" Broadcast Direct Relationship Plan</u>, to take advantage of highly competitive pricing, outstanding support and service, and exclusive product features. The ProHD camcorders are state-of-the-art, and not limited by any need to protect a higher priced product line, as is the case with competitors.





Breaking (Mobile) News: Handheld HD-ENG Camcorder with Wi-Fi Backhaul Connectivity



The TV station news professionals have talked a lot about 4G/LTE wireless backhaul for HD-ENG over the past year, and a number of TV stations across the country are now using bonded multiple 3G/4G/LTE circuits for sending live and near live field video back to the news room with some success. The problem areas seem to be latency and video not quite up to HD OTA standards. The 4G/LTE wireless backhaul is covered in detail later in here. <u>The new discussion</u> this year is about Wi-Fi and TV White Spaces use for HD-ENG backhaul.



Perhaps the most interesting news for the TV station news business is JVC's NAB-2012 announcement that their new top-performing handheld HD camcorder (GY-HM650) will feature <u>a (built-in software) FTP client and Wi-Fi connectivity (through USB Wi-Fi)</u>, enabling the uploading of HD video clips through standard Wi-Fi routers or access points, and backhauling over the wired public (or private) internet. Although a much shorter wireless range than 4G/LTE, Wi-Fi offers versatility and low cost in operations, not to mention opportunities far into the future for ongoing Wi-Fi technology advancements.

The GY-HM650 offers file transfer (FTP) of HD clips already recorded on its internal (removable) SDHC memory cards, potentially transferring faster than real-time, subject to memory card sustained read speed, and IP networking speed over the internet (or the LAN).







Alternative FTP backhaul is through Wi-Fi hotspot enabled smartphone (or tablet or laptop) with 4G/LTE broadband wireless subscription.

Back to the Future: Wi-Fi Access Points for Mobile News Backhaul

Just a couple of years ago, WiMAX was still touted as the future HD-ENG backhaul option for the TV broadcasters taking over from BAS microwave, but it appears that WiMAX (1) have not been built out sufficiently to offer backhaul coverage, (2) that WiMAX equipment and transmission costs involved are too expensive, and (3) that bonded (and single circuit) 3G/4G/LTE backhaul appeared more interesting and less costly. What is this WiMAX again? WiMAX is a wireless

digital communications system originally intended for "wireless metropolitan area networks" (W-MAN). Theoretically, WiMAX can provide broadband wireless access up to 30 miles for fixed stations, and 10 miles for mobile stations. In contrast, the older WiFi/802.11 wireless local area network standard is limited in most cases to only 100 - 300 feet. WiMAX operates on both licensed (regulated environment) and non-licensed frequencies.



WiMAX is a "stationary modem" oriented system, with "WiFi short range modem roots", but with longer range mobile wireless capabilities. However, WiMAX is no longer a serious option for mobile newsgathering, primarily for the reason that the WiMAX-type services are being abandoned by main stream U.S. telecom operators, <u>converting WiMAX wireless spectrum to 4G/LTE use</u>.





Remember that the future of Mobile Newsgathering, in the expansion of local news coverage through "lone ranger" video journalists equipped with professional handheld HD camcorders (i.e. ProHD 600/650 Series), requires simple-to-operate backhaul facilities without (significant) latency but with 99% reliability, local HD broadcast quality and low access/transmission costs. WiMAX is being abandoned, and 4G/LTE cannot reliably produce 99% up-time with the required HD quality all across the DMAs. We're now talking breaking news, with the requirement to get the coverage or clips back to the newsroom right now, with no time to drive the recorded media back and risk getting stuck in traffic on the Hollywood Freeway.

And the additional requirement should ideally be that the VJ needs no additional support equipment, like "HD encoder/bonding backpack" or "equipment belt", added to the handheld camcorder in order to transmit the video clip back to the newsroom. <u>Is this doable</u>?

YES, through Wi-Fi connectivity combined with wired broadband, 4G/LTE and sometimes BAS microwave, as Wi-Fi can be made an integral part of the handheld camcorder, as is available in the new ProHD GY-HM650 VJ Camcorder through its USB port.

The most recent Wi-Fi standard is 802.11n, capable of a data-rate exceeding 300Mbps (in certain implementations) with a reach of up to 450 feet (150m) and dual 2.4 and 5GHz band operation. Nominal data-rate is 100Mbps, still much more than required to transport a compressed HD file at real time. The limitation in Wi-Fi hotspot applications is that the remote Wi-Fi device (the ProHD camcorder) must be located less than 450 feet from the access point.

What about White Spaces and "Super Wi-Fi"?

First of all, "Super Wi-Fi" is not an approved or officially named standard, but rather just a term invented (by, some say, the FCC). White spaces have been discussed at length within the TV broadcasting community over the past several years. "TV White Spaces" (TVWS) refer to the TV broadcast spectrum not utilized in the various DMAs around the U.S. as each TV market generally has assigned non-adjacent TV OTA channels and in many cases (in smaller DMAs) several 6MHz channel spacing between each local full power TV channel.

Such unused TV channels may be used for one-way or two-way communications, subject to limiting transmitted power (in milliwatt, or perhaps watts, rather than in kilowatts) and subject to exceptional spurious frequency and out-of-band emission control to avoid interfering with local TV channel reception, and to avoid on-channel and adjacent channel interference reaching into neighboring (or even more distant) DMAs. Remember that a TV home located in a fringe field strength area of the DMA, receiving OTA television through a very weak signal, may easily be the subject of adjacent channel interference from a White Space TVBD (TV Band Device) transmitter located in the same neighborhood.





That's why the FCC imposes very strict limitations on the use of White Space TVBDs. Similarly, to attempt to use a TVBD in near proximity to a full power TV station (adjacent channel) transmitter may easily overload the front end of the TVBD receiver.

An open/permitted 6MHz white space channel can potentially carry up to 20Mbps of data, which is more than sufficient for a live high quality compressed HD stream transmitted from the handheld camcorder back to the VJ's vehicle, ENG Van or other collection point. The distance from the camcorder back to the receiver could potentially be measured in miles, subject to the receiving site using a directional elevated UHF receiving antenna. This is the advantage of using unlicensed white space TV channel for camera-to-vehicle/internet access point backhaul over Wi-Fi's limited range of less than 450 feet. However, the disadvantage is that the unlicensed 6MHz white space channel available on Tuesday may not be available on Friday!

Today, on the average, rural areas offer about 20 TV channels not used, while suburban areas have around 10. In the largest DMAs, this may drop to less than 10. However, after the latest FCC proposed Spectrum Grab of another 20 UHF TV channels (2015 transition?), the unused TV channels will drop significantly due to repacking, thus materially reduce the availability of usable White Spaces. Another white space advantage is that the UHF TV frequencies are able to penetrate buildings and structures which the current 2.4 and 5GHz Wi-Fi frequencies are much less able to do. (Although TV VHF band is generally workable, the Author believes that the longer wavelength and different/larger antenna properties and lesser control over propagation make TV VHF frequencies less attractive for initial HD-ENG backhaul relay, particularly the low VHF band – 54-88MHz.)

The clear advantage with Wi-Fi available in a handheld camcorder is that it is an established well-working standard (Wi-Fi) is able to communicate with a wide variety of existing devices and services from many wireless and networking vendors. The "Super Wi-Fi" white spaces (emerging) standard is currently in final development referred to as 802.11af, applying 802.11b/g/n technology to white spaces with appropriate modifications to meet FCC regulations for TVWS/TVBD. This "Super Wi-Fi" technology uses orthogonal frequency-division multiplexing (OFDM) and involves one, two or more contiguous and/or non-contiguous TV channels to get the higher data rates. The FCC mandated modifications include meeting the requirements for frequency agility and channel (availability/anti-interference) sensing. The 802.11af standard is expected to be completed in 2012.





Any built-in "Super Wi-Fi/White Space" radio in a HD camcorder must be designed together with the remote "Super Wi-Fi" transceiver "base-station" unit, more or less custom implemented for the HD-ENG backhaul purpose for maximum benefit to mobile newsgathering.

Let's conclude this White Spaces discussion by (tentatively) agreeing:

- <u>The GOOD News</u>: The TV UHF band seems very attractive for HD-ENG camcorder short range initial wireless backhaul, to relay the video from "roaming field location" back to ENG vehicle or internet/microwave access point, from the reason of radio frequency propagation and the ability to build a "Super Wi-Fi" radio into a handheld camcorder.
- <u>The BAD News</u>: The current white spaces in the current TV UHF band (pre-FCC spectrum grab: Ch.14 to Ch.51 470 to 698MHz) offer fair opportunities for unlicensed "Super Wi-Fi" operations, however, once the soon-to-come FCC spectrum grab of 120MHz of TV broadcast UHF spectrum has been accomplished (2015?), then the white spaces TV UHF opportunities shrink considerably to just the free local channels within the band 470 to 572MHz. After FCC channel relocation and repacking of all remaining TV stations nationwide, <u>there may not be sufficient TVWS spectrum for frequent and reliable mobile news backhaul</u>.

The Not-so-Successful "City-wide" Wi-Fi Hotspots: Advertising-based free Wi-Fi did not work?

A number of years ago, several venture capital supported start-up companies negotiated deals with a number U.S. cities to provide free Wi-Fi service to residents and businesses by installing Wi-Fi access points ("AP") on utility poles, lamp poles and exterior walls throughout the city. These municipal Wi-Fi systems were generally advertising-based (before one gains free access to the internet, the user must endure an initial ad page or banner ads), although subscriptionbased was available if faster connections were desired.

One such city was Portland, Oregon, making a deal with a now defunct company, which claimed to have 550 live outdoor access points in operation within the city in mid-2007. By mid-2008, the venture was shut down due to lack of advertisers and subscriptions, and, presumably, lack of need as most residences and businesses subscribe to wired broadband internet service through their CATV or TelcoTV companies. There is a "citizen-movement non-profit company" in Portland trying to resurrect a city-wide free public Wi-Fi system, including using the abandoned APs left by the failed advertising-based venture. <u>So, if you're thinking free city-wide Wi-Fi hotspots, think again</u>!





The New Wi-Fi Hotspots:

Suddenly, the local CATV Company is your best buddy?

Every DMA has at least one CATV company delivering cable television and wired broadband services to local subscribers, which cable plant includes a substantial fiber/coax return path of the 2-way digital services. The latest data communication spec for such wired broadband internet service is labeled <u>DOCSIS 3.0</u> (Data Over Cable Service Interface Specification), an international standard that permits the addition of bi-directional high-speed data transfer to an existing cable TV system. DOCSIS (at various levels) is employed by most cable television operators to provide Internet access over their existing hybrid fiber-coax (HFC) infrastructure.

DOCSIS 3.0 is capable of a downstream data-rate of more than 300Mbps and an upstream data-rate of more than 100Mbps. In an HD-ENG backhaul application, the upstream capacity is of primary interest.



<u>The CATV operator in your DMA has the (very likely) ability to locate a Wi-Fi hotspot in any</u> <u>location near its cable plant</u>, whether urban or suburban, indoor or outside. The variable is the cost of such a hotspot (costly downtown, much less so in the suburb) and then how soon the investment will pay off for the CATV operator (or for the TV station if paying for several HD-ENG Wi-Fi hotspot APs).

What's the TV station's interest in such Wi-Fi hotspots? Simple: The new "video journalist" camcorders may include Wi-Fi radio connectivity through a Wi-Fi adapter plugged into the camcorder's USB port, such Wi-Fi facility interoperating with the camcorder's built-in FTP facility, to automatically upload a video news clip to the newsroom through any nearby Wi-Fi hotspot/access point. We need to differentiate between the LIVE remote shoot and the near live, the near live being shot and recorded, and then as quickly as possible uploaded as a video clip to the news room. It is obviously cost prohibitive for the TV station to pay for Wi-Fi hotspot installations throughout the DMA, even in a supplemental role. However, for the TV station to consider funding CATV system owned Wi-Fi hotspot locations in let's say 10 key locations throughout the DMA may be operationally beneficial, as such key locations may be City Hall, Federal Building, Airport, Police HQ, Major League venues, and DMA fringe locations, where the TV station HD-ENG backhaul may be agreed as a part of any local retransmission agreement.







Wi-Fi Direct

Look at above illustration. Wi-Fi Direct allows Wi-Fi devices to connect to each other without going through a wireless access point. Traditional Wi-Fi networks comprise at least one wireless access point, normally combining (a) physical support for wireless and wired networking, (b) bridging and routing between devices on the network, and (c) management functions to add and remove devices from the network. A Wi-Fi home network is generally based on a wired connection to a broadband internet provider, <u>the access point</u> (the Wi-Fi router with separate or built-in cable broadband modem), connecting computers and other devices by wire and wireless.



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In traditional Wi-Fi networks, the access point (Wi-Fi radio/router/bridge) is the central hub to which Wi-Fi capable devices are connected. The devices must go through the access point in order to communicate. <u>Not necessary for Wi-Fi Direct devices</u>.

<u>All Wi-Fi Direct (certified) devices</u> may operate either as a device or an access point, negotiating when they first connect to determine which shall act as an access point. Wi-Fi Direct devices include an embedded software access point ("Soft AP") and provide a version of Wi-Fi Protected Setup for secure connections. When any Wi-Fi capable device enters the range of a Wi-Fi Direct host, it can connect and gather setup information. Connection and setup is simple, like Bluetooth but with a much longer range. Soft APs can be simple or complex as required by the device, illustrated by a Wi-Fi enabled camcorder's ability to upload video clips to the newsroom, including connecting and uploading through a Wi-Fi Direct smartphone via 4G/LTE bridging to the (wireless broadband) internet. Wi-Fi Direct. Only one needs to be WiFi Direct while all the others just need some level of (certified) WiFi capabilities.

What is 4G/LTE ... really?

Will the real 4G (4th Generation of mobile wireless standard) please stand up!

Several years ago, 4G was understood to mean the following:

- A "high speed moving" data rate of up to 100 Mbps per client
- Up to 1 Gbps per client while client is in fixed or stationary locations
- A data rate of at least 100 Mbps between any two points in the world,

To the true professionals in the 4G wireless industry, it still means that. But the 4G term has been "hijacked" in the U.S. by the broadband wireless providers to mean the following (at this time) which speeds are not likely to be offered faster (to each user) for some time:

- Downlink speed of about 3 to 12 Mbps
- Uplink speed of about 1 to 5 Mbps

For the consumers, including business users, those are the data-rates one can expect from what's advertised today as 4G/LTE broadband wireless service. In using 4G as HD-ENG backhaul, our interest is in the uplink speed, currently limited to about 5 Mbps unless "special higher uplink speed contracts" are available from the providers.







Any 4G compliant mobile device (smartphone, laptop/tablet, hotspot box, etc.) must be capable of communicating over a WiMAX or LTE Advanced wireless infrastructure, or both. With WiMAX being abandoned, the LTE infrastructure is being expanded and used for what's called 4G service. What sounded very promising for live HD ENG backhaul over 4G a couple of years ago is now not quite so exciting, primarily because of uplink data-rate limitations. The BAS microwave links will be around for several more years for backhauling important live events.

What is LTE Advanced?

LTE stands for "Long Term Evolution" ("Advanced" is the last step in a longer term LTE upgrading from 3G to ultimate 4G) and is now supported by most major mobile carriers in the U.S, as it is easier to convert to 4G through "long term evolution" rather than through a difficult switch to WiMAX. Both AT&T and Verizon are 4G/LTE oriented, while T-Mobile seems to be offering "equivalent 4G service" through their HSPA+ implementation. Sprint is now moving away from WiMAX embracing LTE networks as it is expanding 4G service nationwide.



Thus 4G/LTE means that the technology has evolved (is still evolving) in many stages by the LTE progression schedule, but has not yet reached the ultimate 4G performance promised by internationally agreed performance progression table.





Live HD-ENG Backhaul over 4G/LTE: Bonding or Not . . . that is the Question

Hundreds of TV stations around the US are already doing HD news from a new HD news set, equipped with HD studio cameras, switchers and support equipment at investment level of a million dollars or more per TV station. But HD studio news by itself, without live HD ENG, is no longer a major competitive edge in many Top-100 Markets, although a must. **HD news <u>and</u> live HD ENG together is now the competitive necessity.** It's all about the ratings and audience share, which in turn is about attracting more and more local eyeballs, as an ever increasing HD viewer base watches television on HDTVs. One of the most important tools in 2012 to increase overall audience share is live HD ENG, and for HD-ENG video to reasonably match the picture quality of your HD news studio. <u>And, the challenge is to establish such live HD ENG capabilities</u> <u>with sufficient field capacity (cover multiple remote news events concurrently), HD quality and</u> in the most cost effective way, to optimize your bottom line in 2012 and into the future.

One approach is to rely on the good old BAS microwave backhaul, which may require expensive retrofit of (and even buying more) ENG trucks in terms of HD capabilities. With professional HD-ENG camcorders being relatively inexpensive to acquire and providing live compressed outputs, coupled with the desire and ability to expand the "lone ranger" video journalist staff while reducing reliance on "staff-heavy" ENG trucks, TV stations have been exploring recent offerings of live backhaul over 4G wireless broadband service, such equipment often packaged in a backpack which may be operated by a "lone ranger" video journalist in the field.

Live HD from the field to go on the air needs to be (at least) near HD broadcast quality not to look like SD in comparison to the TV station's HD studio picture quality. And we all remember that a local TV station's live HD news studio is delivered to the viewers at a very high HD quality, particularly OTA which involves only one CODEC cycle (the ATSC encoding/decoding). So, it's a tall order to deliver the live HD from the field at near matching HD studio quality, without using a BAS HD microwave link. SD is acceptable for fast breaking news from the field, but the competitive target is always to get live remote HD at a level of consistent quality (and reliability) as close to the HD studio quality as possible before your main DMA competitor does. <u>What does that mean in compressed data-rate terms</u>?

Compare Netflix HD streaming delivery over the internet, delivering 720p30 at somewhat less than 4 Mbps encoded MPEG-4/H.264 at an acceptable HD quality level, even on a larger home HDTV set. But bear in mind that the H.264 encoder/processor used by streaming companies like Netflix are of high quality and sophistication (and expensive), and field-based H.264 encoders, whether inside HD camcorders, camera-back units or inside backpacks, are not likely to produce comparable compressed HD quality at lower bitrates as the \$20,000+ encoders used by the major VOD streaming companies.





And when the 720p30 is doubled to the p60 broadcast standard, the equivalent quality compressed bitrate may not necessarily double, but perhaps require about 6 Mbps. Using 1080i60, as interlaced is less efficient to compress, may require up to 8 Mbps.

So, a high quality (and expensive) H.264 encoder in the field may produce the acceptable near HD studio quality pictures at around 7 Mbps, where a lesser sophisticated (and relatively inexpensive) H.264 encoder may need 10+ Mbps to produce the same picture quality. Settling on the less expensive H.264 encoder <u>and</u> accepting a bit less overall HD picture quality, we arrive at a LIVE HD backhaul bitrate of around 6 Mbps. <u>How does 6 Mbps HD-ENG backhaul fit into 4G/LTE uplink data-rates?</u>

Not quite. The 4G/LTE uplink capacity will of course vary from DMA to DMA, and possibly from day to day, and from location (cell) to location (cell) within the DMA. If an average 4G/LTE uplink speed is 2 Mbps, then you need three (3x) times 4G/LTE 2 Mbps circuits to relay LIVE HD at 6 Mbps. And adding some margin and overhead, probably 4 circuits.

<u>This is where BONDING of multiple 4G uplink circuits fit in</u>. Look at the illustration below showing a HD-ENG signal flow from camcorder to TV station to air.







Bonding = Divide > Transmit > Receive > Combine

Rather than just subscribing to one 4G/LTE service, you subscribe to four (4) "4G telephone numbers" or "4G data circuits" (or any other quantity of separate broadband wireless circuits making sense). And, in addition, you buy or lease the HD-ENG Backhaul Bonding System package which includes the remote field equipment which will encode/compress, IP encapsulate, split the ~6 Mbps HD stream into four, and then transmit the four streams over the four separate 4G/LTE circuits back to the TV station news room or master control, where the TV station "Bonding Receiver" receives the four separate streams and combines the four into one compressed signal, to be decoded to HD-SDI for LIVE on the air.

And the multiple bonding channels working together in a system may be from one or more of the major broadband wireless providers, i.e. two (2) from Verizon, two (2) from Sprint. <u>Or it may get even more complicated than that in a larger DMA</u>, where two of the wireless providers may



provide strong coverage in the DMA's eastern area while two different providers may be strong in the DMA's western area. Thus, in such a case, the TV station may need to subscribe to multiple "4G data circuits" from all four major providers and secure (purchase/lease) 4G/LTE HD-ENG backhaul systems capable of having perhaps as many as 6 or 8 "4G data circuits" available and ready to go on line in the field-pack at all times.

TVU networks Corporation is just introducing a brand new camera-back mounted field unit which includes HD encoder, IP encapsulator and multiple 4G/LTE radios bonded through TVU's proprietary Inverse Statmux module providing maximum multi-circuit transmission efficiency. See above illustration. This may signal a phasing out of the back-pack approach over time.

The missing IP packets & latency

The HD-ENG backhaul of LIVE video over 4G/LTE circuits is by IP packets, as most digital communication is today. The LIVE compressed video is IP packetized, divided into (let's say) four separate virtual IP transport connections where each connection may be routed through the IP network differently, in the end for all packets to arrive at the destination (TV station) at different times, requiring a buffering and time sorting of the packets to make sure they are all assembled in the right time sequence prior to decoding to HD-SDI. And, by the way, some of the packets were lost in the transport process, to be reconstituted by the embedded FEC (Forward Error Correction). All this causes latency which may exceed several seconds.





The single circuit 4G/LTE Uplink alternative



One vendor (LiveEdge/Nomad Innovations, Inc.) avoids bonding, relying on just a single 4G/LTE uplink connection by operating with their own proprietary HD compression scheme. The advantage with the LiveEdge system is that no backpack is needed, as the field unit is of a size which attaches to the back of the camcorder, between its body and the battery.

HD-ENG Backhaul over 4G/LTE works well . . . but

The field is getting competitive as the 4G/LTE video backhaul technology is propagated around the world, with or without bonding, as more vendors emerge with competitive solutions. At this year's NAB (2012), we can expect to count perhaps as many as eight vendors in this game. This is very good for the TV stations and Mobile Newsgathering, as costs come down, sustained average uplink speed increases, and the market seeks to make such backhaul less complicated by perhaps preferring better single 4G/LTE circuit implementations.

Purchase, rent or lease? With fast moving technology and the promise of faster 4G/LTE uplink speeds soon, an outright purchase of a backhaul 4G/LTE sub-system seems a questionable proposition in 2012 especially when the purchased equipment may be operationally proprietary and tied to specific longer term 4G/LTE backhaul IP transport contracts. Rent or lease may be the answer.

How much better is the bonded backhaul service as to operational reliability and HD picture quality than the single circuit approach? With H.264 encoded bitrate being the same, bonded multiple circuits when working well must be better that a single circuit. BUT . . . when will we see "guaranteed priority uplink speed" over a single circuit capable of near-studio HD? Whether bonded or single, why carry a backpack if a camera-back unit can do the job well?





FTP supports near-live remote reporting

Internet and IP network entertainment communications are generally accomplished over either a real-time transfer protocol (RTP) or a file transfer protocol (FTP) connection over TCP-based networks. RTP and FTP are standardized IP packet formats, of which RTP delivers LIVE video, as in streaming media, including delivery of ENG LIVE video from remote location back to TV station over the public internet or over a private IP network. FTP transfers files from a client to a server (one host to another host) and is (for example) widely used to upload web pages (including video) and other documents from a PC to a web-hosting server. LIVE remote video over RTP backhaul may not be possible in many instances, due to lack of reliable connection or limited bandwidth over the internet, over 4G/LTE or over local Wi-Fi initial relay. This potential problem arises more frequently if a near-studio-quality LIVE HD is desired as such HD requires many Mbps of reliable bandwidth over time.

One solution may be to record the high quality HD of the remote breaking news clip to the SDHC memory card, and then, after completing shooting the HD clip, the camcorder plays back the HD clip through the built-in FTP facility which is virtually connected to the TV station over an internet connection. If this is a one minute (broadcast) quality 35Mbps compressed HD clip, the file size will be about 300MB with over head. If the average bit-rate capacity of the backhaul internet connection is 5Mbps, the one-minute HD clip will take about 8 minutes of transfer time. If 19Mbps ProHD compression is used (still very good quality HD), then the transfer time is cut in half to about 4 minutes.

A different scenario may be that breaking news remote video is needed immediately, but, for whatever reasons, LIVE backhaul is not available, the one-minute required clip may be recorded in compressed SD at 2.5Mbps, which means that the clip can be transferred over the 5Mbps pipe in about 30 seconds, or <u>faster than real-time</u>.





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GPS in Mobile Newsgathering

We all know the term GPS, abbreviation for "Global Positioning System", a space-based satellite navigation system that <u>provides</u> <u>location and time information</u> in all weather, anywhere in the world, where there is an unobstructed line of sight to several GPS satellites at the same time. The GPS system is owned and operated by the United States government and the "civilianpermitted" satellite data transmissions are freely accessible by anyone with a GPS receiver. "U.S. military-only" signals are



encrypted and not available for civilian use. The "civilian-use" global location accuracy which can be achieved by cost-effective consumer GPS technology is on the order of three (3) meters (~10 feet) horizontally and five (5) meters (~15 feet) vertically, with timing precision to sub-second, believed to be more than sufficient for media applications. GPS satellites fly in medium Earth orbit (MEO) at an altitude of approximately 20,200 km (12,600 miles). Each satellite circles the Earth twice a day. The twenty-seven (27) GPS satellites transmit on the two primary frequencies of 1575.42 MHz (L1) and 1227.60 MHz (L2) of which only L1 is utilized by consumer/civilian application. L2 is for government/military use only in concert with L1.



The new ProHD handheld camcorder <u>GY-</u> <u>HM650 features built-in GPS functions</u>, enabling a number of benefits to the newsgathering organization, including the basic GPS tagging of video clips with date, time and location information. <u>This GPS tagging data</u> <u>is embedded in the metadata space of the</u> <u>MXF-wrapped recorded essence data</u>.

However, the future potential for GPS-fitted HD-ENG camcorders goes far beyond the GPS tagging of video clips, to provide GPS mapping and navigation to quickly aid the news department staff to pinpoint the exact location of the video journalist for purpose of sending additional ENG assets to the scene , and to accomplish directional pin-pointing of remote camcorder/VJ location by news helicopter aloft and the positioning of helicopter-born directional antenna at all times pointed to the remote camcorder/VJ location perhaps to receive HD video being shot by the remote camcorder/VJ.





3xCMOS/3xCCD or Single Sensor for HD?

A most interesting question for TV broadcasters, as new handheld (and shoulder-mount) HD camcorders are brought to market at this NAB-2012, several with single sensor imager. We're now talking 1080/720 HD and NOT 4K acquisition. What gives?

3xSensor Imaging Block yields the most accurate image acquisition

It's really a very simple explanation, as a camcorder's <u>full count 1920x1080</u> 3xCCD (or 3xCMOS) imager assembly contains three (3) sensors each with 2,073,600 active frame-bound pixel/ photo-sites (2.2MP gross), with one sensor assigned to each of RED, GREEN and BLUE colors achieved by beam splitting prism (no/low light loss prism) splitting the light-beam into the three colors for each of the 2+ million pixels composing each video frame. The read-outs of the three sensors, up to 60 times per second for each, are combined through processing to produce the most complete RGB data for each of the 2+ million pixels. From the RGB data, the individual levels of R, G and B are added (per standard formula) to produce the luminance level (Y) for the particular pixel, and then the chrominance components (Cb and Cr) are derived from GREEN and BLUE, and GREEN and RED, respectively (again by standard formula), in the process to convert RGB (4:4:4) to YCbCr (4:2:2). <u>Superior acquisition and color performance are achieved</u>.



Look at the above illustration. The upper light/signal flow shows arriving at <u>true RGB 4:4:4 video</u>. The lower light/signal flow shows the single sensor with 2.2MP. Our first observation is that the 3xCCD (or 3xCMOS) imager contains a total of 6.6 million photo-sites (2.2 x 3 sensors) while the single sensor only contains 2.2 million photo-sites. It seems obvious that 2.2 million must result in inferior video compared with 6.6 million.





The Bayer-type Single Sensor Imager

Patented in 1979 and named after its inventor, B.E. Bayer of Eastman Kodak, a Bayer mosaic color filter array (CFA) aligns red, green and blue color filter squares on top of an array of photosites, in such a pattern that each photosite will only be "exposed" to either red, green OR blue light spectrum. In any "standard Bayer" array, there are 50% green, 25% red and 25% blue photosites. See illustration below. To Bayer, green largely determines luminance value while red and blue are largely chrominance determinants. Light hitting a photosite generates a voltage (analog, varying with the intensity of the light) which needs to be read out and converted to data (digital). Exiting the single (2.2MP) sensor chip, the read-out data from each of 2 million+ photosites is formatted into a very high data-rate signal referred to as <u>RAW data</u>.



Half of all 2.2 million photo-sites are GREEN = 1.1 million, while there are 0.55 million RED and 0.55 million BLUE. <u>Before</u> any "de-Bayering" processing and interpolation, the RAW data contains a luminance capture resolution far below the 1920x1080, with a sampling resembling 2:1:1 looking at the sampling frequency for 1.1 million pixels at 60p compared with 2.2 million (RGB 4:4:4) at

60p. The RAW data must be "de-Bayered" and interpolated to yield a resolution approaching 1920x1080, but which will never reach the image accuracy and color performance of a 3xCCD (or 3xCMOS) imager (all other things being equal). The "de-Bayering" and interpolation is a process whereby the values of adjacent photo-sites are considered in arriving at complete (but approximated) RGB data for each pixel. Remember that every GREEN pixel is missing RED and BLUE data, every RED pixel is missing GREEN and BLUE data, and every BLUE pixel is missing GREEN and RED data. This "de-Bayering" and interpolation must happen in real-time up to 60 times per second, requiring substantial processing power within the camcorder to produce the real time internal RGB (RAW and RGB are not available –and not needed- as outputs – in TV broadcast camcorders) before generating the YCbCr (4:2:2) for HD-SDI and/or HDMI outputs.

Which HD 4:2:2/4:2:0 is better: From 3xSensor or Single Sensor?

All other things being equal, the RGB from the single sensor is <u>always computed by estimation</u>, thus the resulting conversion from RGB (4:4:4) to 4:2:2 results in less accurate registration, contrast and color reproduction. <u>The winner is the camcorder with the 3xSensor imager</u>.









Handheld "Video Journalist" HD ENG Camcorders



ProHD is an integrated family of new HD cameras, camcorders and system components, designed for professional television, with emphasis on the competitive local news environment and on the new approach of "self sufficient" video journalists, delivering unprecedented HD format and solid state recording flexibility through a highly attractive performance-price ratio.



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ProHD 600/650 Series: Advancing Mobile Newsgathering

The All New Mobile News Camcorders

JVC Broadcast is introducing two new exciting models of handheld HD camcorders at NAB-2012, the GY-HM600U and the GY-HM650U, which products are certain to advance the art of Mobile Newsgathering and HD-ENG by including a collection of features and performance not before offered in the world of mobile news cameras in this highly attractive price range.

Mobile Newsgathering is now promising to be faster and better than ever with the availability of JVC's 600/650 Series. Small and light enough to be used anywhere, these advanced cameras surpass the performance of many traditional ENG style units and offers capabilities never before available on any model. For example, on the HM650, <u>dual codecs make it possible to record two different file formats simultaneously</u>: full HD on #1 SDHC memory card and a smaller web-friendly (or SD) file on #2 SDHC memory card. And to transfer the clips back to the station with the built-in FTP client and WiFi connectivity.



The 600/650 Series of camcorders is designed for next generation newsgathering. Light-weight, versatile and extremely easy to use, both cameras are designed for fast paced ENG—offering superb low light performance and a high sensitivity of F11 @ 2000 lux, a long (23x) wide angle zoom lens, and fast file-based interoperability from acquisition to air. Look at the following features and specs:





| ProHD 600/650 Series Features & Specs (Selected specifications) | GY- HM <mark>600</mark> U | GY- HM <mark>650</mark> U |
|---|------------------------------|------------------------------|
| 1/3-inch 12-bit 3xCMOS sensors (1920 x 1080) | \checkmark | ✓ |
| F11 Sensitivity @ 2000 lux | \checkmark | \checkmark |
| FUJINON 23x Autofocus zoom lens (29mm to 667mm) | \checkmark | \checkmark |
| Optical image stabilizer | √ | ✓ |
| SDXC/SDHC memory card recording(2 slots) | √ | ✓ |
| Dual Codec: Recording simultaneously HD + SD or HD + Proxy (for Web delivery and other applications) | | ✓ |
| Multiple encoding formats: | | |
| HD MPEG2 (35/25/19Mbps) | \checkmark | \checkmark |
| AVCHD 1920x1080 50/60i | √ | ✓ |
| SD H.264 | ✓ | \checkmark |
| Wide media format compatibility: | | |
| .MXF with rich Metadata (for asset management) | | \checkmark |
| .MOV (Final Cut Pro) | \checkmark | ✓ |
| .MP4 (XDCAM EX™) | √ | ✓ |
| AVCHD | \checkmark | \checkmark |
| Built-in GPS | | \checkmark |
| Support for WiFi with Apps for iOS/Android for remote control, remote viewing, metadata upload | | ✓ |
| FTP file upload via WiFi connectivity | | √ |
| High performance 2D DNR | √ | √ |

NOTE: Specifications and features are preliminary and subject to change.

Capture Excellence under challenging light conditions

A most important trait of any HD-ENG camcorder is the ability to produce acceptable video under challenging light conditions, when shooting outside during night time or in interior space with dim lighting where no additional lighting is possible or permitted. The 600/650 models meet that challenge with its stated sensitivity of F11 @ 2000 lux and its minimum illumination spec of less than 1 lux.

Lumen is the amount of light radiating from a light source. For example, a 60W old fashioned light bulb may radiate 900 Lumens. Lux is a metric measure of illumination: Lumen per square meter. The "F-stop @ 2000 lux" spec is used around the world to indicate the ability of camcorders to capture high quality video at a mid-range of illumination level (without applying available additional internal camcorder gain). A camcorder's F-stops are the various aperture openings of the lens' iris control, determining how much light is allowed to enter through the lens and reach the imaging sensors, subject to the shutter speed. Look at this illumination environment table:





| Illumination Environment | Approx. Lux | ProHD 600/650 Adaptability |
|--|----------------|-------------------------------|
| Direct sunlight | > 50,000 | \checkmark |
| Full daylight | > 10,000 | \checkmark |
| Overcast Day - TV Studio | > 1,000 | ✓ |
| Well-lit Office | 500 | \checkmark |
| Good Main Road Lighting (Evening-Night) | 15 | √ |
| Typical Side Road Lighting (Evening, Night) | 5 | \checkmark |
| Deep Twilight Outside | 1 | \checkmark |
| Clear Full Moon | 0.3 | Difficult |
| Typical Starlight | 0.001 | No usable image |

<u>JVC's exclusive LoLux gain feature</u>, incorporated in a number of JVC's ProHD camcorders, goes beyond the normal gain boost to assist video journalists under severe light conditions to produce broadcast acceptable video, when it is not possible to use additional lighting.

Full Count 1920x1080 3xCMOS 12-bit Sensors

Three 1/3-inch progressive scan CMOS sensors in a traditional RGB prism assembly provide rich, accurate colors through a 12-bit A-to-D conversion of photo-site read-outs, delivering a precision scale of 4,096 discrete levels for each pixel-point. The three (3) full count 1920x1080 sensors, each with 2,073,600 active photo-sites (2.2MP gross), are progressively sampled and read out up to 60 times per second, subjected to high performance 2D Digital Noise Reduction and processing in real-time by JVC's proprietary next generation Falconbrid high speed picture engine/processor, resulting in TV broadcast quality uncompressed HD.

This first generation uncompressed HD video is available on both HD-SDI and HDMI outputs, concurrent with the recording of compressed video to one or both of the SDHC/SDXC memory cards.







Powerful 23x Zoom Lens with Autofocus

The 600/650 Series camcorders feature a 23x Fujinon HD zoom lens with autofocus, with focal length from a wide angle 4.1mm to a telephoto 94.3mm (<u>35mm equivalent</u> = 29mm to 667mm), providing a high level of flexibility in HD-ENG field acquisition of close-up subjects and distant objects. The following table details lens classifications by commonly used terms, like Fish-eye, Wide Angle etc. and indicates focal length (in 35mm film equivalent terms) and range of Field of View (FOV, or Angle of View AOV by an alternate term) for each lens classification.

| Lens Classification by Field of View (FOV) | Focal Length (35mm equiv.) | Range FOV (degrees) | 600/650 Series Camcorder 23x Zoom Lens Coverage |
|---|-------------------------------|------------------------|--|
| Fish-eye | 8 - 14mm | 180 - 114 | Rarely used for Mobile/TV News |
| Ultra Wide Angle | 14 - 24mm | 114 - 84 | Rarely used for Mobile/TV News |
| Wide Angle | 24 - 35mm | 84 - 64 | Max FOV = ~67 degrees (29mm) |
| Normal | 35 - 60mm | 64 - 40 | Wide Angle to |
| Medium Telephoto | 85 - 135mm | 30 - 10 | Super Telephoto coverage |
| Super Telephoto | > 300mm | 8 - 1 | Min FOV = ~3.2 degrees (667mm) |

Note that the Fish-eye and Ultra Wide lenses are not generally needed for mobile/TV news, and that any lens selection required by a video journalists is amply covered by the permanent 23x zoom lens of the 600/650 camcorders (blue shaded area of table above). Focus is controlled manually or automatically. A smooth servo zoom is operated through a conventional rocker on the handgrip and a rocker on the carrying handle, or by turning the lens manually.



The 600/650 Series features very effective optical image stabilization as well as auto-focus with face detection.

JVC's Patented "FOCUS ASSIST" function is included, achieving exact focus through a fast,

easy and accurate process.





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Exceptional Interface Opportunities = Supports Fast Workflow

Both the GY-HM600 and GY-HM650 feature HDMI and HD-SDI uncompressed outputs, AV output and 2-channel MIC input through XLRs with phantom power capabilities. In addition, the GY-HM650 features USB port for connecting the Wi-Fi adapter.



USB>Wi-Fi = Easy Wireless Local Connectivity



The built-in FTP client software in the HM650 works in concert with the USB port and a Wi-Fi Adapter to provide wireless transmission through selected Wi-Fi hotspot (Wi-Fi router or Wi-Fi Direct fitted device such as 4G/LTE smartphone/box/laptop /netbook/tablet/PC) which can connect to the internet for file transport (FTP) back to TV station.



Wi-Fi Upload of Video Clip & Wi-Fi Remote Control Apps

The Wi-Fi facility includes wireless remote control of camcorder functions through applications running under iOS (Apple devices) and Android OS, in addition to remote viewing and metadata upload and download. Remote control and remote viewing may include POV (Point-of-View) installations.





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Exceptional Flexibility in File Formats & Encoding

The 600/650 Series of handheld camcorders features a wide selection of raster and file formats, enabling the video journalist to shoot efficiently for any type of delivery, whether HD broadcast or webcast. Look at table below. The 650 model offers eight (8) rasters from 1920x1080 down to 352x240, four (4) file formats in MOV, MP4, MXF and AVCHD, in MPEG-2 or H.264 compression.



The encoded bit-rates range from highest broadcast quality long GOP 35Mbps down to as little as 800Kbps for 480x270. Frame rates cover the world-wide requirement of 60, 50, 30, 25 and 24Hz.

Dual CODECs

The 650 model also features Dual CODECS enabling concurrent recording to each of the two SDHC/SDXC memory cards of two different file formats (of the same scene, of course). A typical primary application of the Dual CODECs feature is for the #1 SDHC memory card to be recorded in full HD, perhaps in broadcast quality 35Mbps in MXF to preserve all metadata, while the #2 SDHC card is simultaneously recording in SD in MOV H.264 to yield a low bit-rate (perhaps as low as 2.7Mbps) and thus a small file size which can easily and rapidly be backhauled to the TV station with the built-in FTP facility (over Wi-Fi?) to immediately go on-the-air once received.

A one-minute HD clip at 35Mbps with overhead generates a 300MB (MegaByte) file size, which may take many minutes to backhaul, depending on the upload speed. Comparatively, the concurrently recorded SD version at 2.7Mbps generates a file size of about 25MB which would take less than a minute to FTP. Let's call it a FTP transfer time ratio of 10:1 between highest quality HD and lowest quality SD which may still be acceptable in a breaking news, must go on air now situation, when live ENG is not available.





Or record two file formats ... concurrently ... for 2 TV screens!

As the HM650 model features two (2) internal (removable) SDHC/SDXC memory cards for realtime recording, although generally on one memory card at a time, and two (2) fully independent CODECs, these unique features allow "dual file format recording" on both cards at the same time (of the same scene), for purposes of (a) fast advance FTP of a small file back to newsroom, (b) primary plus archive/back-up recording, and (c) to record for two different screen formats at the same time. The primary memory card records HD (for full HDTV viewing) while the secondary memory card may record in SD, or in proxy resolutions.

Remember the 3 Television Screens? Some say there are 4. Others say 2. You decide. Look at the illustration below. At the two extremes, we have <u>large</u> HD and <u>small</u> smartphone/webcast window screen sizes. In the event that the same stories are to be supplied independently to two different departments (i.e. TV newsroom and website team, and where each will independently edit the material), it may be efficient to record HD (1080 or 720) to #1 SDHC while concurrently recording webcast window resolution (480x270) to #2 SDHC memory card.







The "Top-of-the-Line" Shoulder-mount: GY-HM790 Solid State Media Camcorder

The GY-HM790 combines JVC's popular ProHD shoulder form factor with a new level of performance suitable for demanding applications in HD ENG and HD Studio, built on cutting edge solid state recording technology offering the choice of using the very economical and widely available SDHC memory cards or the fast SxS card standard. SxS operation requires the addition of the KA-MR100 camera-back SxS Media Recorder between the camera body and the battery. SDHC recording is included as standard fit.

Some of the GY-HM790's exciting features are:

- Patented 3-CCD optical system delivers full HD resolution
- Full in-camera 4:4:4/4:2:2 processing prior to encoding
- Full bandwidth 4:2:2 HD-SDI output and built-in genlock
- Down-converted SDI output Live or Playback
- Full support of 1080i and 720p, as well as 480i
- Time code input/output Pool feed input
- New high performance Canon 14x lens included
- Records to dual hot swappable SDHC memory cards in .mov or .mp4
- Professional HD recording at 35, 25 or 19Mbps in .mov or .mp4
- Native Final Cut Pro/FCX format Immediate editing
- New HiRes LCOS "large eye-piece" digital viewfinder (1.2 Mpixels)
- Patented Focus Assist function
- Large 4.3-inch Flip Out LCD monitor
- Uncompressed LPCM 2-Ch. audio recording







A New Level of HD-ENG Camcorder Flexibility

A new 68-pin Multi-signal Interface Connector available at the rear of the camera body provides "clutter-free" connectivity to a wide selection of optional attachments, offering the ultimate in use flexibility and versatility. Except for the studio interface module, the other three options are also available for the GY-HM710 and GY-HM750.





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ProHD On-Board Recording Exclusive: Choices in HD and File Formats!

And record simultaneously on dual SDHC high capacity, highly reliable, yet economical memory cards

Several years ago, JVC and Sony agreed to combine the original ProHD 720p60 with the EX (.MP4) 18, 25 and 35Mbps in the new expanded ProHD format family, and for JVC to support Sony's SxS solid state flash memory cards in addition to JVC's own recently available SDHC dual-slot integrated memory card recording sub-system. All ProHD camcorder models released in 2010 and



later now support all major HD signal formats in MPEG2 long GOP, which is the most widely accepted broadcast compression standard supported by all popular editing systems and broadcast servers:

| 35Mbps (VBR) | 25Mbps (CBR) | 19Mbps (CBR) | |
|--------------------------------|-----------------|-----------------|----------------------------|
| 1920 x 1080/60i | 1440 x 1080/60i | 1280 x 720/60p | |
| 1920 x 1080/50i | 1440 x 1080/50i | 1280 x 720/50p | |
| 1920 x 1080/30p | 720 x 480/60i | 1280 x 720/30p | |
| 1920 x 1080/25p | | 1280 x 720/25p | NOTE: 60 = 59.94 |
| 1920 x 1080/24p | | 1280 x 720/24p | 30 = 29.97 |
| 1440 x 1080/60i (.mov only) | | | 24 = 23.98 |
| 1440 x 1080/50i (.mov only) | | | |
| 1280 x 720/60p | | | |
| 1280 x 720/50p | | | |
| 1280 x 720/30p | | | |
| 1280 x 720/25p | | | |
| 1280 x 720/24p | | |] |

ProHD now means exceptional flexibility, recording any of the above HD formats in real-time on the fully integrated dual slot SDHC memory card recorder, a built-in feature on all recently released ProHD camcorders.





Native File (Fast-to-Air) Acquisition

Immediate editing in Final Cut Pro & Adobe Premiere

All ProHD camcorders (released in 2010 and later) incorporate JVC's **Native File Recording** technology, storing video in a Ready-to-Edit file format (.mov) on the SDHC/SDXC memory cards, which file format is used and accessed directly by Apple's Final Cut Pro and the Adobe Premiere non-linear editing systems.

The **".mov**" file extension indicates a QuickTime container for a video clip (including audio). The ProHD camcorders wrap the MPEG-2 compressed video stream and the 2 channels of uncompressed digital linear PCM audio in the **.mov** QuickTime format. This enables immediate recognition of the format by any Final Cut Pro-based (FCP) workstation as the SDHC media is plugged into the workstation through appropriate slot or interface, and to accomplish Ready-to-Edit performance without lossy (and time consuming) conversion, transfer or transcoding.



Except for complex editing of 35Mbps material requiring multiple (near-concurrent) rapid media access, editing is accomplished direct from the SDHC card without the need to file transfer. HD ENG is one application where FCP and SDHC join ProHD for Fastest-to-Air performance, with an extremely favourable ROI model.

The ProHD-SxS recording format is GOP-based MPEG-2 compression contained in **.mp4** container file. The SxS workflow takes advantage of the very fast transfer capabilities of the SxS memory card, thus the SxS does not generally provide for Direct-to-Air editing, but recommends a transfer of all clips from the SxS to the editing workstation or server prior to editing. ProHD's support of SxS file formats makes it easy for TV news departments to transition to ProHD camcorders in the field while maintaining the SxS workflow in the newsroom and editing suites.





Comparing Memory Media for HD-ENG

Secure Digital High Capacity (SDHC) memory cards are widely available around the world, currently in capacities up to 32GB in high performance Class 10. A typical use in HD-ENG seems to be 32GB. SDXC (XC = extended capacity) cards are now being brought to market in 64GB, but, if you need just one (1) to three (3) hours storage per card, then the 32GB remains the most cost effective high capacity SD card in 2012. All ProHD camcorders (released in 2010



and later) feature 2 memory card slots, totalling 64GB of on-board removable storage (using 32GB cards) for up to 6 hours of continuous recording. Unlike the purpose-designed relatively expensive SxS and P2 media, SDHC per hour cost (at 19 Mbps ProHD) is now only \$13, creating an environment where media cost in HD-ENG is insignificant in the overall picture, including the cost of archiving solid state media on-the-shelf. The SDXC version provides for higher on-board capacities above 64GB when needed.

| 32GB Flash Memory Card Cost per Hour @ Bit-rates | Street Price 32 GB | Street Price per Hour | Time Capacity Hi Bit-rate | Time Capacity Lo Bit-rate |
|---|--------------------------|-----------------------------|---------------------------------|---------------------------------|
| Sony SxS SBS-32G1A | \$449 | \$280/Hi | 1.6 hours | 3 hours |
| Compression 35/25/18 Mbps | Ϋ́Υ, | \$150/Lo | @ 35Mbps | @ 18Mbps |
| Panasonic P2 AJ-P2E032XG | \$425 | \$850/Hi | 0.5 hour | 1 hour |
| Compression AVC-I 100/50 Mbps | | \$425/Lo | @ 100Mbps | @ 50Mbps |
| JVC ProHD (Transcend) | \$39 | \$25/Hi | 1.6 hours | 3 hours |
| SDHC Class 10 Speed (high) | | \$13/Lo | @ 35Mbps | @ 19Mbps |
| Street pricing obtained from major media reseller on March 23, 2012 | | | | |

JVC is the first HD camcorder manufacturer to have offered native file professional HD format recording on economical SDHC memory cards <u>and</u> accomplished "direct-memory-card-editing" for fast "go-to-air-now" performance.

<u>What is the service/archival life of an SD memory card?</u> SD standards-based memory cards, like most semiconductor cards, store information in flash memory. The current technology along with normal usage typically gives the card a lifespan of 10 years or more, indicating that TV news departments should prepare for long term archival transfer of (worth-while) news clips to new media prior to the older media reaching the age of 10 years. In addition, redundant archival copies on different long-term media are highly recommended.





ProHD supports fast end-to-end (-to-air) workflow

Invariably, the production workflow for news clips from acquisition to air involves equipment from several manufacturers, of which JVC is primarily participating with HD cameras and camcorders. It is therefore essential that each of the manufacturers' equipment "represented" in the end-to-end workflow chain are compatible in terms of accepting and delivering a common file or streaming format, to provide easy interoperability at time of implementation as well as through the years as equipment is updated and improved. The new handheld GY-HM650 camcorder will support the MXF (Material Exchange Format) standard by saving compressed clips under .MXF file names to the internal SDHC/SDXC memory cards. Such MXF files may include rich metadata added automatically when shooting (GPS location and date/time) and manually by the VJ in any field camcorder set-up and field editing process.



MXF and File Wrappers

A file wrapper in its simplest form is a data container file which includes the actual video and/or audio data (essence), whether uncompressed or compressed, plus auxiliary data describing or providing information about the media essence (metadata). MXF is a file wrapper format. In order for a receiving device (i.e. editor or server) to make sense of the MXF file supplied to it, the device must have the ability to understand the MXF data it receives, and to split it into a video/audio data/stream (essence) and metadata (information about the essence). The device must be MXF format compliant. The new handheld GY-HM650 will be MXF compliant in the origination of metadata from the point of view of an acquisition device, which metadata will particularly be essential in efficient operation of a TV station's media asset management system.

New format XQD Memory Cards for Mobile Newsgathering?

Do we need yet another flash memory card format? <u>The short answer is NO, but read on</u>. The Compact Flash Association (CFA), based in Silicon Valley of which the executive corporate (controlling) members include Canon, Sony and SanDisk, is the managing spec and license organization (and trademark owner) behind the established CF card and the new (just shipping) XQD card, an entirely NEW memory card format with the following specifications:





- Entirely NEW size 38.5 x 29.8 x 3.8mm (not pin compatible with existing card slots)
- PCI Express Bus 2.5Gbps throughput (312MB/s)
- Actual Write Speed target: 125MB/s (1Gbps)

XQD cards have just become available. B&H shows a price of \$230 for a 32GB card (\$7.19 per GB). This compares with \$39 for a 32GB SDHC (\$1.22 per GB) and \$180 for a 64GB SDXC (\$2.81 per GB). The smallest SDXC capacity is 64GB. That makes XQD nearly 6x more expensive than SDHC and more than 2.5x more expensive than SDXC, in \$/GB.



The long established SDHC Class 10 guarantees a transfer speed (sustained capture) of not less than

20MB/s (160Mbps) sufficient for the large majority (if not all) of compressed bit-rates used in TV broadcast HD camcorders, including MPEG-2 and H.264. However, manufacturers now offer Class10 and UHS (Ultra High Speed) SDHC and/or SDXC cards with speeds up to 90MB/s write and 95MB/s read. For higher capacity SD cards (>32GB), choose SDXC (the follow-on after SDHC). A sustained SD read speed of 90MB/s (720Mbps) will transfer a one-minute 35Mbps (broadcast quality compressed HD) ENG clip in less than 5 seconds (subject to surrounding technology supporting the ultra-fast transfer speed). Or transfer a one-hour clip in less than 4 minutes.

JVC's new HD-ENG camcorders (with dual SD slots) are compatible with both the SDHC and SDXC, which SD memory cards are quite capable to cover all compressed HD-ENG recording situations, very economically, including Class 6 & 10, and UHS1

The Author concludes that the XQD memory card is really developed for DSLR cameras with a requirement to dump a very large still file (uncompressed and lightly compressed RAW data) very rapidly to built-in camera memory so that multiple very large raster images can be shot in rapid succession. As an example, a professional DSLR camera (still camera but also capable of multiple rapid successive stills and 1080p60 video) may have a single large (35mm) format sensor with up to over 30MP (mega-pixels), requiring very large RAW data dumps (the faster, the better). The Nikon D4 DSLR is believed to be the first camera to feature built-in XQD memory slot. No such "large RAW data dump" need exists in HD-ENG applications, thus <u>all HD-ENG camcorder applications are served very well by the SDHC/SDXC memory card products far into the future</u>.





ProHD is also "Local HD Studio Live" ...

More TV Stations and HD Production Facilities install ProHD in Studio Camera Configurations for broadcast quality HD on the air

The KA-790 is the sturdy (passive) mechanical studio housing which enables the GY-HM790 to be converted into a professional studio camera system. The necessary signal connections (power, genlock, intercom, prompter etc.) are routed directly through the camera body itself, through the industry standard 26-pin multi-core connector available on the optional rear-mounted studio interface module (KA-M790). Full remote control of all camera functions is



available through a range of optional JVC camera remote control units, or added to an existing studio camera control system with minimum cabling.



WKRC-TV Cincinnati, OH (Nielsen DMA Market #35) is now in their third year of successful operations with ProHD cameras in full studio configuration.

Why ProHD in the TV Studio?

Lower acquisition cost, full HD broadcast quality and outstanding reliability, backed by JVC's incomparable "Broadcast Direct" support, translate into a "win-win" long term relationship. ProHD/Studio offers extensive remote camera control capabilities and workflow integration with powerful HD ENG camcorders and editing. The single vendor scenario for all cameras & camcorders results in highly cost effective acquisition and operations.

Change is inevitable – Keep your options open . . . Live HD ENG makes you highly competitive . . . ProHD makes your HD News highly cost effective . . .



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JVC Broadcast Direct



A Sales & Support Organization dedicated to TV Broadcasters

JVC Broadcast Direct is a new program offered largely to Group Station Owners to achieve successful transitioning at their local TV station properties to full and highly competitive HD news operations through the adoption of cost effective ProHD acquisition systems, and, as importantly, to assure the ongoing uninterrupted daily operation of ProHD equipment at the highest possible level. JVC's core commitments under a Broadcast Direct group adoption agreement include:

- Direct buying from JVC under net-30 or capital lease
- Purchase at substantial discounts (Adoption pricing)
- Direct station-level support by JVC technical/operations staff
- Depot service and product loaner program (Immediate turn-around)
- Exclusive performance and features (i.e. LoLux and Metadata)
- JVC Support Web Portal (Repair, purchase history, manuals, pricing)

JVC Broadcast Direct simplifies the ongoing purchasing and transition process, and includes initial setup of cameras and lenses, an exclusive depot service support program, and the very important training for technical and production staff by JVC product experts. All this to assure a highly successful ownership experience on a daily basis, including JVC placing ProHD camera/recorders at strategic locations as backup equipment when a TV station's equipment is sent to our depot for repair. Such gear is owned by JVC but available to the TV stations for the life of the adoption agreement. JVC's endeavor is to generate a win-win situation that will benefit all parties for now and the future. The success of ProHD will assure longevity and continued product developments to the benefit of the Group Station Owners through product continuum.



Join the Win-Win JVC Broadcast Direct Relationship





Please contact JVC Professional for additional information and product demonstrations:



On Air. On Time. On Budget.



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