

THE **ProHD** 2009 REPORT

Top-100 DMA Markets Transition to Live HD ENG:

Fast Workflow
High Picture Quality
Affordable Investment
Low Operating Costs



Already in over
50 DMA Markets
Covering more than
55 Million Viewers

Live HD ENG: Executive Overview *Page 3*

What is ProHD? For Decision Makers *Page 12*

Higher Ratings – Lower Investment *Page 23*

Case Study: Live HD ENG Transition *Page 39*

US TV Markets – DMA Top-100 *Page 42*

Table of Content

	Page
EXECUTIVE OVERVIEW	3
Live HD ENG . . . Your most important competitive edge	3
Get more local eyeballs	4
Fast "Go-to-Air" Workflow	4
High Professional Picture Quality	5
Affordable Investment	5
HD News Studio Camera	7
Low Operating Cost	7
Even more local eyeballs	8
The new economy of local news	8
HDTV Household Penetration	9
Value of Demographic Segments	10
The TV Station-to-Home Delivery Chain	11
WHAT IS ProHD?	12
ProHD On-Board Recording Exclusive	13
Professional Flash Memory Storage Media	14
Super-fast SxS is now ProHD	15
Super-economical SDHC is also ProHD	15
Cost-effective Memory Card Archive	16
Native File (Fast-to-Air) Acquisition	17
GY-HM700 Solid State Media Camcorder	18
ProHD is full resolution choice: 720p and 1080i	18
Professional Docking SxS Memory Card Media Recorder	19
GY-HM100 Solid State Media Camcorder	20
LIBRE Microwave Camera-back System	20
SxS & SDHC -- Interface to any Laptop, any Desktop	21
ProHD is: Local HD Studio Live	22
HIGHER RATINGS -- LOWER INVESTMENT	23
Smart technical choices	23
Live HD Remotes = BAS 2GHz Relocation	23
Easy Microwave = First-to-Air	25
Live HD ENG Backhaul to TV Station	26
Workflow options inside the ENG Van	28
Workflow options inside the TV Station	29
ProHD compatible Non-linear Editing Systems	30
Remote HD POV applications = ProHD	32
WiMAX & IP -- Broadband Backhaul for HD ENG	33
Fiber-wired IP backhaul	34
Microwave, Fiber IP or WiMAX?	35
Lenses for HD ENG	36
SD lenses on HD Camcorders	37
CASE STUDY -- Top-20 Market -- LIVE HD ENG TRANSITION	39
APPENDIX DMA Top-100 TV Markets	42

IMPORTANT: This ProHD-2009 Report has been authored by nordahl.tv LLC on behalf of JVC Professional Products Group. Competitive specifications stated herein are believed to be accurate at time of writing. Readers of this Report are encouraged to contact other sources including other manufacturers to obtain the latest specifications, as well as points of view and analysis other than those presented and concluded in this Report. **Trademarks:** All company, product and systems names and trademarks found in this Report are the sole property of their respective owners.

EXECUTIVE OVERVIEW

Live HD ENG . . .

Your most important competitive edge

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.



HD News Set at WTVR Richmond, VA (Nielsen DMA Market #58) equipped with JVC GY-HD250U camcorders mounted in highly cost effective studio configuration.

At NAB-2007, we counted just 30-some TV stations around the US with significant HD local news origination (each having announced HD news), largely by converting their SD news set to HD, but with very 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 in 2007 going to a HD studio news set at the local level, even without HD ENG on-air capability.

Now, at NAB-2009, we count about 160 TV stations around the US already doing HD news from a new HD news set, many equipped with HD studio cameras, switchers and support equipment costing millions of dollars.

HD studio news by itself, without live HD ENG, is no longer a major competitive edge in many Top-100 Markets. The next level is Live HD ENG.

Live HD ENG makes you highly competitive . . .

**Already in over 50 DMA Markets,
covering more than 55 Million Viewers**

More and more television breaking news will be accessed on portable devices with limited resolution, but TV stations’ primary outlet and revenue generator will remain the millions of home viewers who demand HD quality content to be displayed on their HDTV sets. Content is king, but the audience ratings victor will be the TV station with the best live news images day after day, as we can assume that, in the news business, the TV stations in the same market deliver more or less the same news stories each day.

Your presentation to the audience must be better than the competition, in journalistic terms as well as in HD quality terms. HD from a news studio is relatively easy these days . . . however, cost effective Live HD ENG requires smart decisions, management courage and the right technology. Differentiate your station from the others, be the first with Live HD ENG news in your market, and do it economically, preferably before the other stations do.

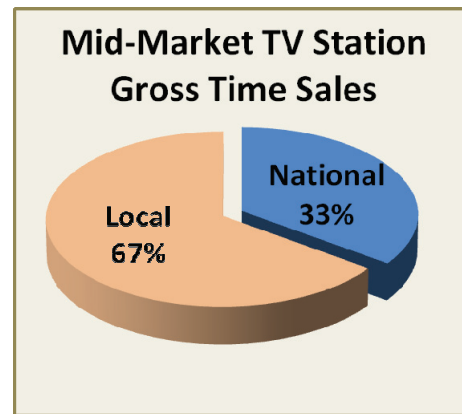
Market leading local news is critical to generating local time sales and maximum revenue. HD news and Live HD ENG will obviously make your local market position stronger.

Get more local eyeballs

The local, regional and national news markets will become more and more competitive over the next several years, as cable, web-based and mobile video news services develop, causing local TV advertising dollars to consider moving to newer electronic media. Your TV stations, having done news for years, already have the necessary base infra-structure from which you can launch your HD market attack, to increase your audience share for news and, indirectly, for day-time and prime-time programs.

Just as network programs lead-in and build your local news audience, great local news broadcasts will lead-in and build audience for network and syndicated programming, as your popular local news talent may promote your prime time and syndicated shows.

A Mid-Market TV Station typically gets about 2/3 of total revenue from local time sales, and only 1/3 from national time sales. Higher ratings are driven by your station's ability to attract additional eyeballs, a direct function of providing better and more interesting content, of which a larger part is HD News and Live HD ENG.



The objective of this Report is to give the reader, whether in engineering, news, production or executive management, a solid foundation upon which to make the best decisions in the transition from SD to HD ENG news. And the best HD equipment decisions in local news are in these three areas, in this order:

Fast “Go-to-Air-now” Workflow

Breaking news in the field require that your station can go on-air with Live HD ENG faster than the competition. Your station is first to break the local story, with live remote HD. Breaking the news first in SD is good, but not good enough if the station across town is on-air with live remote HD, even if a bit later than you. You may get some eyeballs for a minute, but the competition will eventually get the eyeballs owning HDTVs. And the number of HDTV set owners is growing fast!

High Professional Picture Quality

The HD picture quality from any recently installed station HD news set is stunning, watching the live studio talent through OTA (over-the-air) ATSC transmission directly to the eyeballs' HDTVs in the home. The digital DTV ATSC delivery chain delivers spectacular HD picture quality in 99%+ of local HDTV homes, with even a marginal antenna! Cable and satellite delivery of HD? Nearly as stunning.

What is highest picture quality? It is **not** the picture quality demanded by the "golden eyes" in the post production suites and digital film studios in Hollywood, Burbank and Manhattan. It is **not** the picture quality demanded by major TV networks' test labs on West 57, West 66, or 30 Rock in Manhattan or on Pico Blvd in LA, viewing under ideal conditions on calibrated HD monitors.



WXYZ Detroit, MI (Nielsen DMA Market #11) HD ENG vans are equipped with JVC GY-HD250U camcorders, for Live HD ENG use.

The highest picture quality in Live HD ENG is what appears to the home HD audience as being comparable in quality to what is presented on the home HDTV OTA from the live HD studio news set. Meaning? Your TV station's HD newscast shall be uniform in HD picture quality whether the transmission to the home HDTV audience is live from the HD news studio or live from the remote truck. That should be the test in our opinion.

Affordable Investment

You may be surprised to know that there is a way to achieve the essential combination of Fastest Workflow and Highest Picture Quality in Live HD ENG through reduced investment as compared with the other currently available professional HD camcorders and formats.

JVC's ProHD is that Low Investment approach.

There are FIVE distinct elements to the ProHD Affordable Investment promise:

ProHD "Super-Encoded" HD format at 19Mbps

The ProHD camcorder features a built-in broadcast quality HD Super-Encoder supplying a realtime "live" compressed HD stream at about 19Mbps over a widely used Firewire output port. This Reason #1 combines with Reason #2 to potentially save hundreds of thousands of dollars for the average Top-100 TV station.

Affordable Investment Reason #1

The ProHD 19Mbps Live HD stream is a perfect HD ENG microwave fit

The FCC's new microwave BAS (Broadcast Auxiliary Service) 2GHz relocation, currently in its final transition stages, re-structures the channel bandwidth from 17MHz (old analog use) to 12MHz for the new digital era. Regrettably, only 8MHz of the 12 can be reliably used for COFDM modulated RF signal, due to COFDM's out-of-band spurious carrier generation (re-growth), thus requiring a 2MHz guard band on each side of the 8MHz primary bandwidth. Unfortunately, you can ONLY reliably transmit a maximum of 21Mbps in an 8MHz COFDM modulated microwave channel. ProHD 19Mbps is a perfect fit using the "Super-compressed" live HD output from the JVC ProHD camcorders to feed into the ENG Van's microwave COFDM modulator, eliminating the need to buy an external \$20,000+ broadcast quality 19Mbps HD encoder for each ENG Van.

**Affordable
Investment
Reason #2**

The JVC ProHD ENG camcorder costs less than half

The complete JVC's GY-HM700 professional ENG camcorder kit (camera, ENG lens, attached SxS non-linear recorder, memory cards, Firewire-to-ASI converter, accessories and case) cost about \$13,000 compared with more than twice that price for a comparable kit from the competition. And, even at twice the price, the competition cannot compete in the Fastest Workflow arena. If we agree that the average Top-100 TV station doing "full service news" may have 10 ENG vans, then the investment savings just from the HD camcorders may approach \$200,000.

**Affordable
Investment
Reason #3**

ProHD ENG greatly reduces the cost of TV Station infra-structure

Transitioning from SD to HD news invariably involves the desire to eliminate video tape cassettes and to establish or expand a station-wide long term and archive server architecture, thereby eliminating physical storage space and "sneaker/retrieval" facilities, and greatly reducing purchases of VTRs of many format flavors for years to come. Again, the very low realtime bitrate of only 19Mbps (2.4MB/s) means that a one-minute news clip is only 150MB in storage terms, while the competitions "high end, twice the cost+" HD acquisition system requires at least 450MB and in many cases up to 900MB for a one-minute news clip. Considering a long term and archival server purchase of 5TB (5000GB) for the News Department, the ProHD format allows you to store 33,000 one-minute clips, while the mentioned competitive "high end, twice the cost+ 900MB" format will fill up the server after 5,500 one-minute clips. If your station produces an average of 20 edited clips a day or about 7,000 clips a year, your 5TB clip server will be full after only 8 short months with the competition's format, while it will take the ProHD format 4 years to fill up the server. And consider bandwidth access to your archive/clip server. At ProHD's 19Mbps per stream, a Gig-E network port may simultaneously accommodate multiple write/read stream, easily allowing a large number of your newsroom staff to work on-line in realtime. The competition's several 120Mbps streams may overload the Gig-E network and slow down realtime access, limiting the concurrent realtime access to perhaps as few as 1 or 2 news staffers. There is obvious substantial cost savings in the simplicity and lesser bandwidth requirement of any network using ProHD files and streams.

**Affordable
Investment
Reason #4**

ProHD gives you maximum flexibility: 19Mbps HD ENG & 35Mbps HD Production

The ProHD camcorders offer as standard features the ability to instantly switch from the microwave BAS-friendly 19Mbps HD ENG compression mode to the HD production friendly 35Mbps mode, using the same workflow or, for local HD production for commercials or feature stories, using a more sophisticated editing workflow as the “on-air now” time constraint of HD ENG is not a consideration in local HD production and post. In addition, the maximum flexibility includes recording to professional grade consumer-priced SDHC memory cards OR/AND to professional grade super-fast SxS Express memory cards, including simultaneously! Recycle the SxS cards and put the SDHC on the shelf as archive of raw footage.

**Affordable
Investment
Reason #5**

HD News Studio Camera – Double duty, even lower investments?

If you still need to convert your station’s news studio to HD, seriously consider using the same JVC ProHD camcorder installed with the fully professional studio camera kit, directly compatible with remote control standards, robotics, and teleprompter attachments. And



WZVN Ft. Myers, FL (Nielsen DMA Market #62) HD News Studio is equipped with JVC GY-HD250U cameras installed with the fully professional JVC studio camera kit.

the HD-SDI output is studio quality, full bandwidth HD video, competitive with those “high end” \$100,000+ studio cameras.

Again, this promotes a high level of commonality in your HD camera/camcorder inventory and even lower initial investments and lower ongoing operating expenses, driven by your stations’ need to purchase one product line from one manufacturer, without compromising on the HD quality delivered to the home audience, and remaining highly competitive in your market.

Low Operating Costs

This is a difficult area to predict, as it involves many variables outside of equipment, systems and workflow operations, such as union contracts and management approach to ENG and live news on-air. ProHD supports efficiency in staffing requirements, reduces ongoing consumable purchases and promotes smaller bandwidth charges for the following reasons:

- Smaller camcorder size, simpler system approach, fewer workflow steps and realtime capability makes it possible to reduce total ENG and newsroom staffing.

- Reduces ongoing purchases of consumables, such as video tape cassettes and VTRs, and eliminates the need for frequent expansion of server capacities and network infra-structure.
- The low 19Mbps bitrate may enable to increase the return or contribution link channel carrying capacity, without any increase in ongoing cost of leased fiber or microwave path.

Ever more local eyeballs . . .

You desire even higher audience share for your newscasts, your primary road to higher profitability in dollar terms. And, you want lower cost of investment and operations. A higher audience share for local newscasts is a competitive function of (i) better content, (ii) more likeable talent and (iii) higher quality presentation, let's say, in reasonably equal measures. You miss out on one, and the excellence of the remaining two may not matter. You need all three.

The competitive advantages for the #1 TV station for news in a given market are usually small, supporting an attack (or defending an attack) using new cost effective HD technology must be considered to be part of any larger competitive strategy.

But why worry about live HD ENG in 2009? This is exactly your dilemma. If you delay the live HD ENG implementation, you run the risk that your station will fall behind the other stations in your market, causing you to be on the defensive and losing eyeballs. Be assured that, right now, the other HD news stations in your market are evaluating if not already planning or even implementing live HD ENG. Don't fall behind . . . you really need to make your decision now to start on the live HD ENG track for 2009 implementation, and do so from a fully informed position.

The New Economy of Local News . . . and the "common sense" Engineering Director

In a Top-100 TV Market, it takes real guts for a station's Director of Engineering or Chief Engineer to recommend investing in a dozen or two HD camcorders costing just half of the cost of the "high end" Ikegami, Panasonic or Sony HD camcorders, because of the old tradition of our industry that "twice-the-price" must be "twice-as-good". This is no longer true. Today's Engineering Director is open-minded, at least to the extent of thoroughly evaluating and comparing the choices between the "fast workflow and cost effective" JVC ProHD and the "costly, high end" Ikegami, Panasonic and Sony options. We are confident that JVC's half-the-cost fully professional camcorders and cameras will give your station the competitive edge you need in your local market.

But with the new economic realities in local news, where perhaps total audience has been declining and ad dollars are being shared with other forms of commercial delivery to the home, your station must explore all seemingly viable HD news technology options, where the immediate and long term goals are optimum ROI and profitability.

And don't forget flexibility: If your station spends millions on HD news transition and live HD ENG implementation, you probably have to live with that decision for many years before additional capital becomes available. However, as an example, if you spend "a lot less", you may "buy" flexibility to adjust and re-direct as you experience the new realities of the local news economics as your local market dynamics change over the next several years.

JVC's ProHD partners with leading news editors and servers

The ProHD format is supported by all major suppliers of editing and server systems, including Apple, Avid, Grass Valley and Omneon. Apple? Yes, Apple has become a leading supplier of professional video editing software through their Final Cut Pro (or FCP) application, running on Apple MacBook Pro laptops and Mac desktops, networking seamlessly between the ENG world, your news room and play-out servers utilizing the ProHD format to provide Fast Workflow, High HD Picture Quality, Affordable Investment and Low Operating Costs. A winning combination indeed.

The promise of JVC's ProHD is to allow any TV station to transition to live HD ENG quickly and cost effectively, while providing the professional performance and features expected by TV broadcasters.

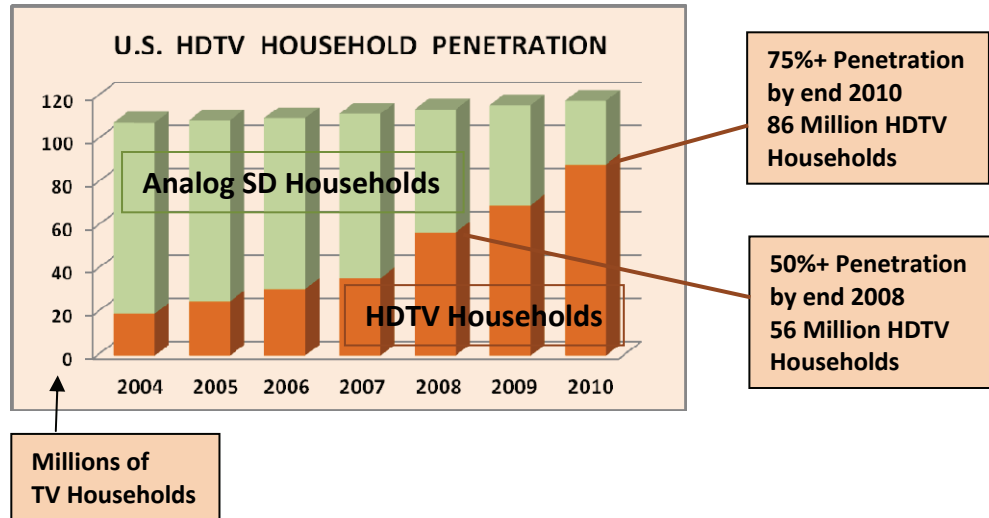
Once you decide to go HD news, then equipment selection is governed by the products available (and working as a system) at that time. With the ever advancing state of the consumer electronics technologies and the availability of consumer HD camcorders for less than \$1,000, and high-end consumer models for under \$2,000, it is even more essential that your local news presentation to your home audience be all HD, and very soon. But it is difficult to justify spending \$40,000 or more each for professional HD ENG camcorders with lenses for the news department these days. This Report may clarify this and other choices for your management team, and, perhaps, be great news for your CFO.

Apple's MacBook Pro is an ideal HD laptop editor for the ENG van, relying on the Final Cut Pro application software and the ability to edit directly from the SDHC card, removed from the camcorder and inserted into Express Slot Adapter in the MacBook Pro, to realize the very fast HD ENG workflow to air.

HDTV Household Penetration

It is estimated that the U.S. has a total of about 115 Million households at the beginning of 2009, growing to around 118 Million by end 2010. About 98% of all households will have one or more TVs of some type, whether old analog SD or new flat screen digital HD.

The transition to HDTV households is moving very rapidly, as seen on the graph presented on next page, sending a strong message to TV station owners that, without a large percentage of HDTV programming and Live HD ENG, the station will not be competitive in the local market place.



Value of Demographic Segments

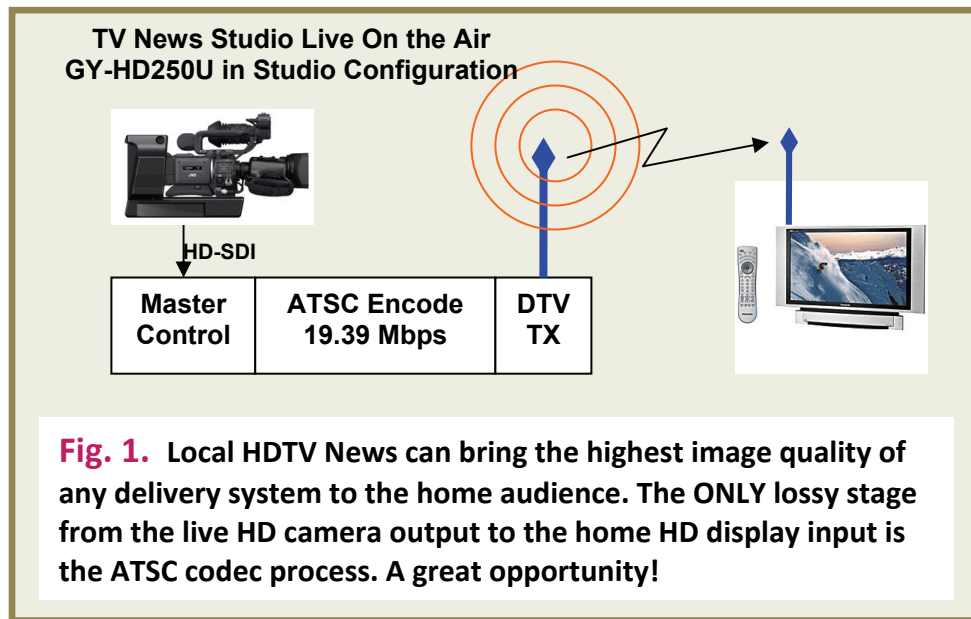
In a survey made in 2003, commissioned by a major TV network, time sales professionals rated the extremely valuable demographic segments in the following order (with our addition about the likely HDTV viewing and purchase ability):

RANK	Demographic Segment	Current Age	Likely to buy HDTV
1	Baby Boomers	42 to 60	Want HDTV, will buy HDTV
2	Generation X	31 to 41	Want HDTV, will buy HDTV
3	“Young” Seniors	55 to 64	Can afford it, may buy HDTV
4	Generation Y	10 to 30	Want HDTV, but lower priority
5	“Real” Seniors	65+	Last for a reason

Couple this with the fact that audiences watching local and national news are on average 45 to 50 years old (not generation Y), your TV station’s quick transition to HD news support an early improvement in local news audience ratings, as those Demographic Segments have bought or will buy HDTV soon.

The TV Station-to-Home Delivery Chain

The shortest path between two points is a straight line! That says it all. The ATSC delivery over the air directly to the home ATSC tuner-fitted HD display is the highest quality consumer level HD delivery path available, bar none. Not even the Blue-ray Discs may be as good, with all its multi-generational authoring and processing, when compared with a TV station's live HD studio camera shots sent over the air directly to the home viewer's ATSC HD set.



A live news studio HD camera supplying HD-SDI through master control directly to the ATSC encoder, then linked to the transmitter, 8VSB modulated, and beamed to the home without any server compression, with no video tape generation loss, no contribution chain artifacts. Only encoded once with ATSC!

Compromising your great local HD news opportunity by delivering SD ENG is a sure way to lose audience share to your competitors.

Live HD ENG makes you highly competitive . . .

ProHD makes your HD News highly cost effective . . .

What is ProHD?

ProHD



GY-HM700



GY-HM100



GY-HD250

What is ProHD?

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, delivering unprecedented HD format and solid state recording flexibility through a highly attractive performance-price ratio.

ProHD On-Board Recording Exclusive: HD Format AND Solid State Media Choices!

**ProHD now includes the XDCAM EX HD formats . . .
Record on SxS professional memory cards OR (better yet) on
SDHC high grade high capacity economical memory cards**

**35
Mbps**

JVC and Sony have joined forces to combine the original ProHD 720p60 with the EX .MP4 18, 25 and 35Mbps in the new expanded ProHD format family, and 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.

Both of the NEW GY-HM100 and GY-HM700 camcorders now support all major HD signal formats including 1920 x 1080, 1440 x 1080 and 1280 x 720.

35Mbps	25Mbps	19Mbps
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		1280 x 720/30p
1920 x 1080/25p		1280 x 720/25p
1920 x 1080/24p		1280 x 720/24p
1440 x 1080/60i (.mov only)		
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 realtime on the SxS memory cards (GY-HM700 only, requires the optional SxS Docking Recorder KA-MR100G) or on the fully integrated dual slot SDHC memory card recorder, a built-in feature on both the GY-HM100 and the GY-HM700 camcorders.

Professional Flash Memory Storage Media (And now cheaper than tape cassettes)

Secure Digital High Capacity (SDHC) memory cards

are widely available around the world, currently in capacities up to 32GB. The NEW ProHD camcorders (GY-HM100 and GY-HM700) each provides 2 memory card slots, totalling 64GB of on-board removable storage for up to 6 hours of continuous recording. Unlike the purpose-designed expensive SxS and P2 media, SDHC per hour cost is actually less than professional video tape, creating the first practical solid state solution to physical archive on flash RAM on-the-shelf.


32GB Memory Card Type	Street Price	Street Price per Hour	Time Capacity Hi Bitrate	Time Capacity Lo Bitrate
Sony brand SxS JVC ProHD SxS	\$925 \$1425 less \$500 rebate	\$578/Hi \$308/Lo	1.6 hours @ 35Mbps	3 hours @ 19Mbps
Panasonic P2	\$1000 \$1400 less \$400 rebate	\$2000/Hi \$1000/Lo	0.5 hour @ 100Mbps	1 hour @ 50Mbps
JVC ProHD SDHC Class 6 Brand Name 	\$102	\$64/Hi \$34/Lo	1.6 hours @ 35Mbps	3 hours @ 19Mbps
Panasonic DVCPRO-HD-LP Tape Cassette	\$115	\$57	Same as Lo Bps	2 hours @ 100Mbps
8GB Memory Card Type				
JVC ProHD SDHC Class 6 Cheap Mass Market	\$20	\$50/Hi \$27/LO	0.4 hours @ 35Mbps	0.75 hours @ 19Mbps

Fig. 2: Table compares cost per hour of storage amongst leading HD camcorder suppliers, and with a typical HD long playing tape cassette. Note that JVC ProHD significantly beats the HD tape cassette cost per hour using 32GB SDHC with 19Mbps compression, and using 8GB SDHC with either 19Mbps or 35Mbps. (Prices and performance found by internet search on March 3, 2009)

JVC is the first (and currently only) HD camcorder manufacturer offering native file professional HD format recording on SDHC memory cards.

Super-fast SxS Pro is now ProHD



SxS is super-fast flash memory, purpose-designed for the latest HD camcorders and the non-linear workstation-oriented environment, providing extremely fast clip transfer to any PC or Mac using the PCI-Express slot interface fitted on all newer laptops, and available by PCI-Express expansion card on desktop workstations. The PCI Express bus is the new PCI standard with a theoretical write or read speed of 250MB/s, nearly twice as fast as the older legacy PCMCIA PC card at 133MB/s.

SxS cards offer effective read and write speeds up to 800Mbps (100MB/s), about twice as fast as the competitive legacy P2 cards using the legacy PC card bus standard.

SxS Product Specification	
Interface	ExpressCard/34 PCI Express
Dimension	Approx. 34 x 5 x 75 mm
Transfer Speed	800Mbps (100MB/s) Max read speed
Storage Capacities	Recording Times (for SxS and for SDHC capacities)
8GB (7.4)	35Mbps/25min – 25Mbps/35min – 19Mbps/50min
16GB (14.9)	35Mbps/50min – 25Mbps/70min – 19Mbps/100min
32GB (30)	35Mbps/100min – 25Mbps/140min – 19Mbps/200min

Super-economical SDHC is also ProHD . . . and Super-Fast-to-Air HD ENG workflow

ProHD gives you the choice:

Super-fast media transfers from SxS Pro memory card to workstation or server when handling larger HD projects, where Direct-to-Air is not required,

OR

Super-Fast-to-Air HD ENG workflow, editing directly off the SDHC memory card without the need to transfer, when Direct-to-Air is essential.

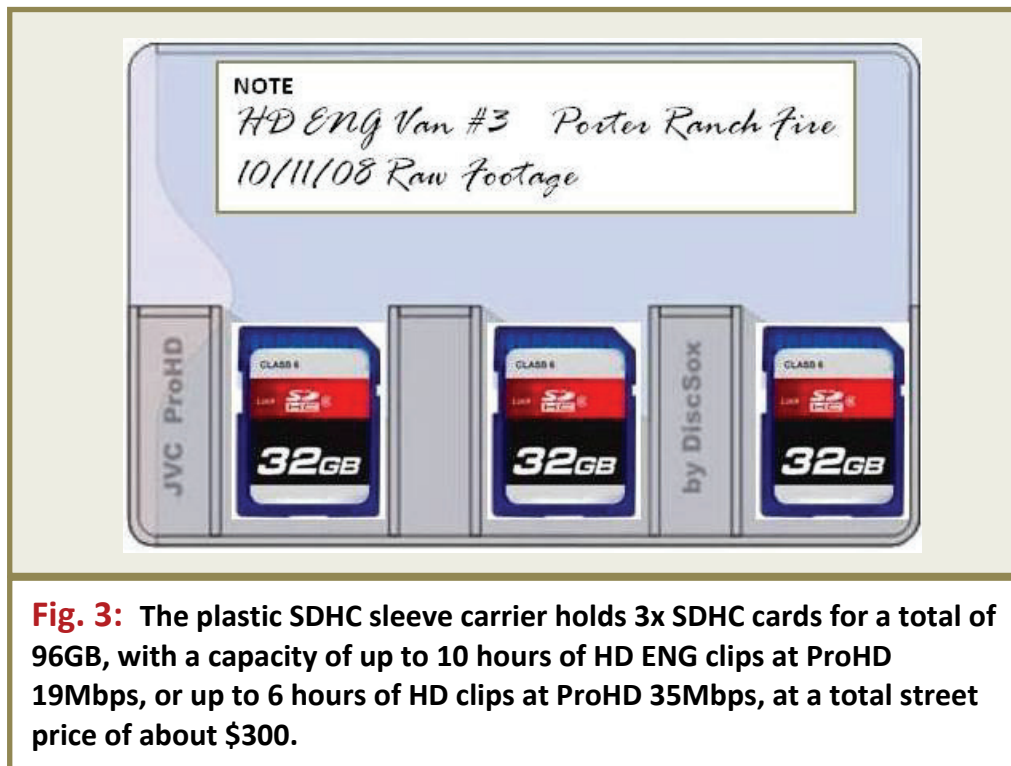


Cost-effective Memory Card Archive

The only sensible solid state “On-the-Shelf” archive approach is with ProHD and SDHC, offering a highly cost effective approach to HD ENG raw footage archive. JVC has designed a plastic sleeve carrier which holds 3 SDHC cards with space to write details about the content. 3 of the 32GB cards (total of 96GB) stores up to 600 minutes (10 hours) of ProHD HD ENG quality (19Mbps).

Assuming a street price of \$100 per 32GB brand-name SDHC card, the total cost of the 3x SDHC cards and carrier is about \$300 for 96GB, for storing up to 10 hours of HD ENG raw material “On-the-Shelf”, or \$30 per hour.

Compare this with 10 hours of typical HD video tape cassettes (like DVCPRO-HD Long Playing cassette), the cost “On-the-Shelf” is nearly twice at \$57 per hour. **And one must consider the physical space requirement of SDHC cards vs. tape cassettes.** The DVCPRO-HD LP tape cassette has a physical volume of about 16 cubic inches, as compared with the plastic sleeve carrier of about 2.5 cubic inches, indicating that (physically) one can store over six (6) plastic sleeve carriers in the space of one (1) DVCPRO-HD LP tape cassette. BUT when you compare time capacities, it becomes really exciting: The LP cassette holds 2 hours of DVCPRO-HD while the six (6) plastic sleeve carriers (each with 3x SDHC cards) holds 60 hours of ProHD. **That’s a physical/time capacity ratio of 30:1 in ProHD’s favor!**



Use SDHC to back up SANs and servers. Even with TBs of SAN or server storage with a commitment to on-line disk-array long term storage, it is still essential to provide “On-the-Shelf” archive/back-up. SDHC cards are ideal for such use, in terms of both physical space and costs.

COMPARE

Same Physical Storage Volume
“On-the-Shelf”

**One (1) DVCPRO HD
126 XL Tape Cassette
About 2 Hours
HD Time Capacity**

**Six (6) ProHD
Plastic Sleeve Carrier
Holds 18x 32GB SDHC cards
About 60 Hours
ProHD Time Capacity**

Native File (Fast-to-Air) Acquisition

Immediate editing in Final Cut Pro without conversion

Both the GY-HM100 and GY-HM700 camcorders incorporate JVC’s ProHD **Native File Recording** technology, storing video in a Ready-to-Edit file format (.mov) on the SDHC memory card, which file format is used and accessed directly by Apple’s Final Cut Pro non-linear editing system.

The “.mov” file extension indicates a QuickTime container for a video clip (including audio) which is proprietary to Apple’s QuickTime. 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 without lossy conversion 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 extremely favourable ROI models.

The “.mp4” file format is a industry-wide standard developed as the MPEG-4 Part 14 by ISO/IEC, directly based upon the QuickTime container format. MPEG-4 Part 14 is essentially identical to the .mov format, but in addition specifies support for other MPEG features. Almost any kind of data can be embedded in MPEG-4 Part 14 included the widely-supported media streams of MPEG-4 AVC, MPEG-2 and even MPEG-1. 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.

GY-HM700 Solid State Media Camcorder



The GY-HM700 combines JVC’s popular shoulder form factor with a new level of performance suitable for demanding applications in HD ENG, as well as in production and cinematography, built on cutting edge solid state recording technology offering the choice of using the very economical and widely available SDHC memory cards or the extremely fast SxS memory card standard shared with the Sony EX product line. SxS and .mp4 operation requires to add the KAMR100 camera-back SxS Media Recorder

between the camera body and the battery. JVC models with an “XT” suffix have the Media Recorder pre-installed. Some of the GY-HM700’s new and exciting features are:

- New 3-CCD optical system delivers full HD resolution
- In both HD News formats 1280x720p59.94 and 1920x1080i59.94
- New high performance Canon 14:1 lens included
- Records to dual hot swappable SDHC and/or SxS memory cards
- Professional HD recording at 35, 25 or 19Mbps -- .mov or .mp4
- New HiRes LCOS viewfinder (1.22 million pixels)
- HD-SDI and down-converted SDI output (live or playback)
- USMSRP \$7,995 including high performance Canon lens
- \$8,995 including the SxS Media Recorder (and lens)

ProHD is Full Resolution Choice: 720p60 and 1080i60

The GY-HM700, by its new market-leading camera front end processing and new 3-CCD 1/3-inch optical sensor block, now outputs full resolution in both 720p59.94 and 1080i59.94. JVC’s new and advanced ProHD capture technology incorporates a new patent-pending Adaptive Pixel Correlation Technique (APCT), which, when combined with the new H-V pixel shifted optical sensor block, delivers exceptional resolving power in both 720p and 1080i, comparable to cameras with larger than 1/3-inch image sensors.

The highly efficient ProHD form of H-V pixel shift, where the Blue pixels' sensor array is shifted ½ pixel horizontally, while the Red pixels' sensor array is shifted ½ pixel vertically (both referenced to the Green array), enables recovery of additional luminance detail between the photosites of each pixel, and, by applying the Adaptive Pixel Correlation Technique, achieves a remarkable improvement in image texture and resolving power at 1080i/59.94. Extensive evaluation of the GY-HM700 proves the effectiveness of the APCT in delivering full resolution 1920x1080, through a large improvement in the MTF (modulation transfer function) at higher frequencies by the APCT determining how to best use the additional samples obtained from the pixel shift.

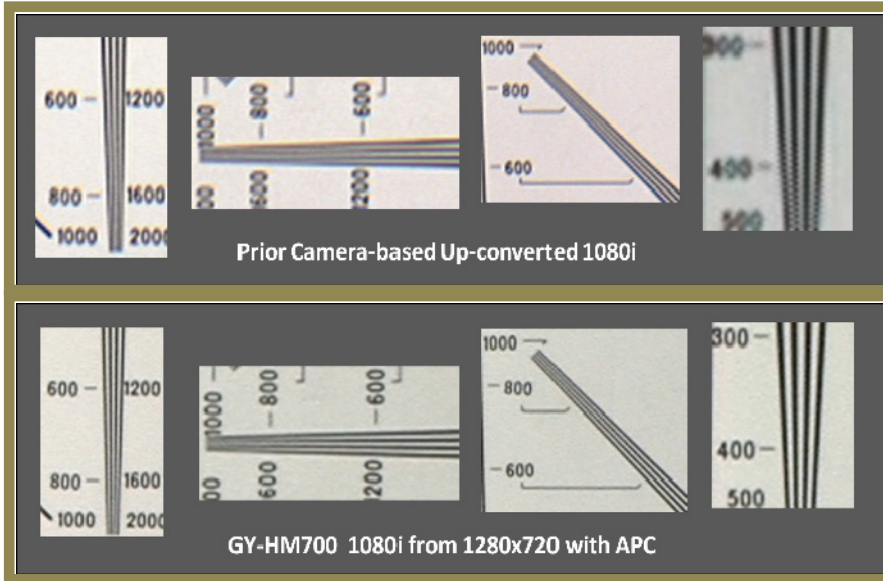


Fig. 4 Test chart 1080i image by earlier model camera, from 720p to 1080i by internal cross-conversion.

Fig. 5 Test chart 1080i image by GY-HM700 camera, showing large improvement in resolving power due to APCT. (Compare with Fig. 4 above)

Once captured in full resolution, whether selected 720p or 1080i, the JVC original “Super-Encoder” encodes at 19, 25 or 35Mbps. This JVC proprietary CODEC provides recorded images of exceptional quality in MPEG-2 GOP format, the most widely accepted broadcast standard compression format, supported by all popular editing systems and broadcast servers. 19 and 25Mbps is encoded CBR (Constant Bit Rate) while 35Mbps is encoded VBR (Variable Bit Rate) as the 35Mbps video is network quality material.

Professional Docking SxS Pro Memory Card Media Recorder

The KA-MR100 SxS Media Recorder docks directly to the GY-HM700 Camcorder, becoming a fully integrated part of the camera, recording **.mp4** media files to a SxS memory card inserted into the dedicated SxS slot. Once the KA-MR100 is docked to the GY-HM700, it is possible to record simultaneously to the SDHC cards AND to the SxS card, either (1) both recording in the **.mp4** file format, or (2) **.mov** on the SDHC and **.mp4** on the SxS. This way, all raw field material is automatically backed up, enabling the erasure of the footage on the SxS card once transferred to a workstation or server without further worries about backing up, as the RAW archival back-up is automatically provided on the very economical SDHC cards ready to be filed away “On-the-Shelf”.



GY-HM100 Solid State Media Camcorder

The ideal camera for News Reporters & Producers



The GY-HM100 is the compact handheld smaller companion of the GY-HM700, offering features and performance found only in larger and more expensive models.

Seasoned shooters will find the small size convenient for work in environments where

larger cameras would be impractical, while producing HD material which can be easily intercut in HD News and HD ENG programs. The capability to record to dual SDHC memory cards in the standard ProHD file format (.mov) in 35, 25 and 19Mbps makes this high performance HD camcorder the ideal companion to the larger shoulder-carried GY-HM700. Outputs include HDMI, easily converted to HD-SDI by external device.

LIBRE Microwave Camera-back System

JVC partnered with BMS to create the LIBRE ProHD Microwave Camera System, enabling live remote (roving) broadcasts in a wireless mode, including in the new 2GHz BAS reduced 12/8 MHz channel spectrum in full HD broadcast quality – offering freedom from cables and freedom from the “customary exorbitant pricing” normally associated with camera-back microwave systems.

The BMS CT2200 Camera-back transmitter mounts fully integrated on the back of ProHD camcorders, accepting pre-compressed HD signal from the camcorder’s built-in broadcast-quality encoder, thus eliminating the need for the microwave transmitter unit to include an expensive internal encoder. ProHD’s “microwave secret” is the HD broadcast quality super-encoder outputting full HD bandwidth compressed stream at just 19Mbps, a perfect bitrate for the COFDM modulator to fit into the 8MHz net channel bandwidth in BAS-HD.



The ultra-portable, high performance and low cost DR2100 Diversity Receiver is located in the HD ENG Van (or at other fixed or semi-fixed location) receiving the COFDM microwave signal from the camera-back transmitter with perfect HD reproduction in line-of-sight

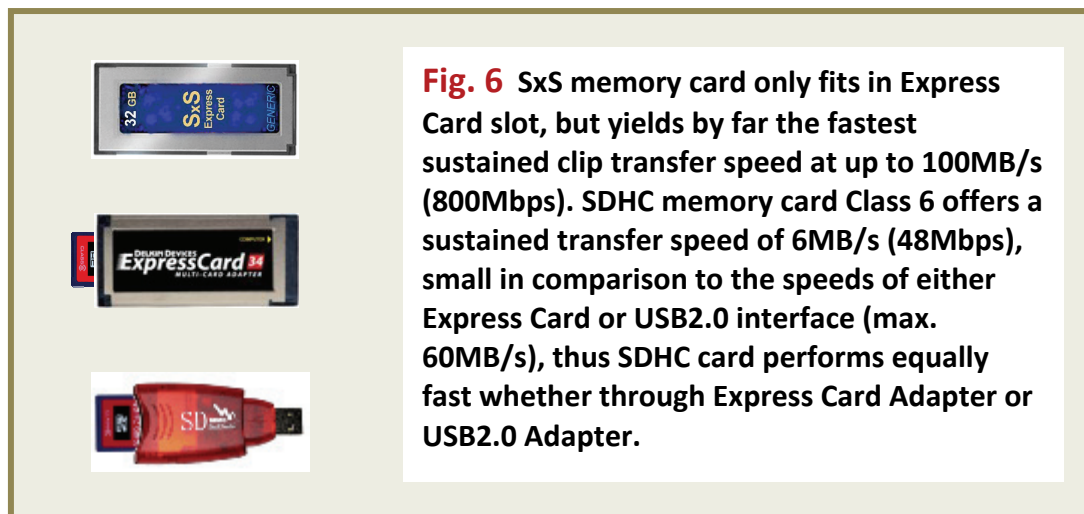
as well as in multi-path conditions. The DR2100 encapsulates the HD compressed signal in ASI and supplies the ASI directly to the ENG Van-to-TV station longer range microwave link, to a satellite uplink terminal, or to a fiber optic link.

SxS & SDHC solid state memory: Interface to any laptop, any desktop

All newer PCs and MACs offer multiple USB peripheral interface ports as standard, with laptops a minimum of two (2) ports (but often 3 or 4) and desktops a minimum of four (4) ports (but often 6 or more). Most newer laptops (especially the higher end models) offer Express Card slot, while newer desktops/towers generally offer Express Card slots as an option, available by installing a PCI Express expansion card internally and the with connectivity on the rear of the computer. Transfer speeds of USB and Express Bus are:

USB2.0 60MB/s (480Mbps) theoretical – USB practical peak is significantly less
The SDHC card Class 6 has a sustained transfer speed of 6MB/s (48Mbps)

Express Bus 250MB/s theoretical – SxS Card practical peak is 800Mbps



ProHD is: Local HD Studio Live!

TV Stations and HD Production Facilities install GY-HD250U in Studio Camera Configurations for broadcast quality HD on the air

The KA-HD250U converts a GY-HD250U into a studio camera, providing necessary signals (power, genlock, intercom, prompter) as well as remote control of camera functions. It utilizes standard JVC or Sony multicore cable and connectors, and can be added to an existing SD control system with no additional cabling.

Equipped with Analog 26P Camera Connector, the KA-HD250U is designed to connect with the RM-P210U & RM-HP250AU Remote Control Units (sold separately). It can be used from up to a distance of 100 meters away. The remote control unit provides power for the camera and thus there is no requirement for a separate power supply for the camera.



WKRC-TV Cincinnati, OH (Nielsen DMA Market #34) opened their new HD news studio in November 2008, fitted with GY-HD250U cameras in full studio configuration.

Why ProHD in the TV Studio?

- Full HD broadcast quality
- Extensive Remote Camera Control
- Workflow integration with HD ENG
- Single vendor for cameras & camcorders
- Highly cost effective in acquisition and operations

Smart technical choices reduce costs AND win more viewers

*Higher Ratings
Lower Investment*

The purpose of this Report is to expose the virtues of ProHD, a highly cost effective HD ENG camcorder and acquisition system, enabling any TV station to quickly and professionally convert any current ENG work flow to HD News and live HD ENG.

Yes . . . it is indeed possible to transition to HD news including live HD ENG, achieve highest level of HD competitiveness in your local market, at lowest investment and lowest ongoing operating costs. JVC would like to show you how with ProHD.

Increase the top line, lowering investment, control expenses and increase the bottom line. With the “final” NTSC turn off in June 2009, and with the consumer HDTV purchases accelerating even in this tough economy, going to HD news and live HD ENG must be a major part of any TV station’s strategy in winning more viewers. The status quo is no longer acceptable.

And the in-camera cross conversion (and output) to 1080i60 is the best in the industry, through the Adaptive Pixel Correlation Technique technology, giving you the clear choices of 720p or 1080i each with HD video quality and fast workflow second to none.



The 2009 HD news/HD ENG transition is about the realities of local news economics, the ability of seamlessly adapting HD ENG into your current work flow, and to preserve your options beyond 2009 to respond quickly to your local market dynamics and changing competition. The smart technical choices, involving lower cost acquisition and operation while maintaining broadcast quality in live HD ENG coverage, are clearly migrating to ProHD’s winning technology offering of SDHC and SxS Solid State Camcorders.

Live HD Remotes = 2GHz BAS Relocation

Local TV news success and audience growth mean Live HD Remote capability, which spells 2GHz BAS relocation. **What is 2GHz BAS relocation?** Simplistically, it is the FCC-mandated relocation of the current licensed broadcast microwave band from 1990 - 2110 MHz to new channels in the 2025 - 2110 MHz band. The seven current 17 and 18 MHz channels will be migrated to seven new 12 MHz channels, thereby saving about 35MHz of spectrum for other (non-broadcast) use.

But new digital microwave technology utilizes COFDM multi-carrier transmitter, which enables non-line-of-sight links (multi-path) in metro areas and in special events coverage, coupled with a QAM modulation scheme. Cable television is using 64-QAM and 256-QAM on single carriers to pack hundreds of SD & HD TV channels on one coaxial cable. The higher the QAM number, the higher the bitrate transmission capability over a given bandwidth, but, as the QAM number is increased, the receiver input requires an ever stronger signal (higher SNR) to reliably decode the modulation. **It is a trade-off between higher bitrates and shorter distances in the HD ENG microwave world.** 256-QAM is easily done through a fiber or coaxial cable, as it's a controlled wired transmission medium, but



256-QAM is very difficult in HD ENG wireless applications, as microwave camera-backs don't have enough TX power and need to use omni-directional whip antennas for the camera-back TX unit as well as for the RX unit (a requirement for dynamic multi-path "roving" performance), generally resulting in unreliable link for 256-QAM. 64-QAM is good, but 16QAM is the best compromise for BAS, which requires less than 21Mbps

to work. ProHD offers 19 . . a perfect match!

From 17/18MHz channels down to 12MHz? The 2GHz BAS relocation reduces channel bandwidth to 12MHz. Can 12MHz do the job? For SD links, 12MHz is ample bandwidth, even to provide reliable two channels of 6MHz each within the 12MHz channel for SD service. But with COFDM, you run into a problem called "spectral regrowth" of the large number of carriers within a single channel with COFDM transmission, causing adjacent channel interference due to the out-of-channel spectral regrowth. The solution is to limit the actual COFDM bandwidth to 8MHz within the 12MHz channel, providing for guard bands of 2MHz on each side. Thus the effective COFDM/QAM channel bandwidth becomes only 8MHz in the relocated 2GHz band (referred to as 8MHz pedestal), with the following performance limitations:

MODULATION	Max Bit Rate 25MHz	Max Bit Rate 12MHz	Max Bit Rate 8MHz	Carrier-to-Noise Threshold
QPSK	32 Mbps	17 Mbps	10 Mbps	10dB
16-QAM	64 Mbps	30 Mbps	21 Mbps	17dB
64-QAM	65 Mbps	46 Mbps	31 Mbps	23dB

Fig. 7. Table shows approx. max bitrates for microwave channels with 25, 12 and 8MHz bandwidth, using COFDM and QPSK/QAM modulation schemes. 2GHz BAS relocation provides for new 12MHz channel width, but recommends 8MHz "pedestal" digital modulation bandwidth when using COFDM due to sideband re-growth adjacent channel interference. Note the 21Mbps in the 8MHz column. ProHD's MPEG-2 TS (Transport Stream) over 1394 is 19.7Mbps, the only HD camcorder able to supply a TS within the 21Mbps limit for reliable 16-QAM link performance through the 8MHz pedestal bandwidth.

The table above gives typical guideline numbers. There are a number of modulation variables including Code Rate/FEC and Guard Interval, coupled with maximum transmitter output power in various modes, to ultimately determine reliable range under specific live remote conditions.

Easy Microwave = First-to-Air

In addition to the HD camcorder-to-ENG Van microwave link, the TV Station must even more importantly consider how to cost effectively and easily accomplish the HD microwave link back to the TV studio from the ENG Van, as this is an essential service every day in the First-to-Air quest. Again, ProHD provides an easy solution through the ability to interface and use many existing ENG Van-to-Studio links.

The key is the presence of an existing ASI input in the current digital microwave transmitter in the ENG Van, accepting a compressed MPEG-2 digital video signal within the ASI interface format. The Super Encoder in the ProHD camcorder provides a very high quality compressed HD transport stream through a 1394-to-ASI Bridge to the microwave transmitter/modulator, eliminating the need to purchase a new HD encoder or to purchase a whole new microwave transmitter with a (expensive) built-in encoder.

HD ENG microwave: Digital is in -- analog is out (No surprise there!) Under the 2GHz BAS Relocation program, the existing ENG (analog) microwave is replaced (generally) with a new digital microwave compliant with the new 2GHz BAS regulations, at little or no cost to the TV station for comparable facilities, which generally excludes HD capabilities. BUT not to worry, as the signal input options to the new ENG Van-based digital microwave transmitters include DVB-ASI, enabling the highly cost effective approach of supplying the pre-compressed 19Mbps ProHD signal over 1394, through a 1394-to-ASI bridge, to the DVB-ASI input of the microwave transmitter.



Fig. 8. JVC's ProHD ENG camcorder fitted with BMS 2GHz microwave camera-back unit (the LIBRE transmitter). The BMS camera-back accepts the compressed MPEG-2 TS (Transport Stream) of 19Mbps, modulates 16-QAM and transmits COFDM over 8MHz bandwidth for roving robustness in HD ENG, sports and EFP applications.

The built-in HD Super Encoder performs comparable to a stand-alone broadcast quality HD MPEG-2 encoder costing upwards of \$30,000, yet the complete ProHD camcorder (GY-HM700) carries a US list price of just \$7,995 (with standard lens). This testifies to JVC's

broad experience in video CODEC design. Just look at JVC's 1U stand-alone rack mountable HD MPEG-2 broadcast quality encoder DM-JV600U.

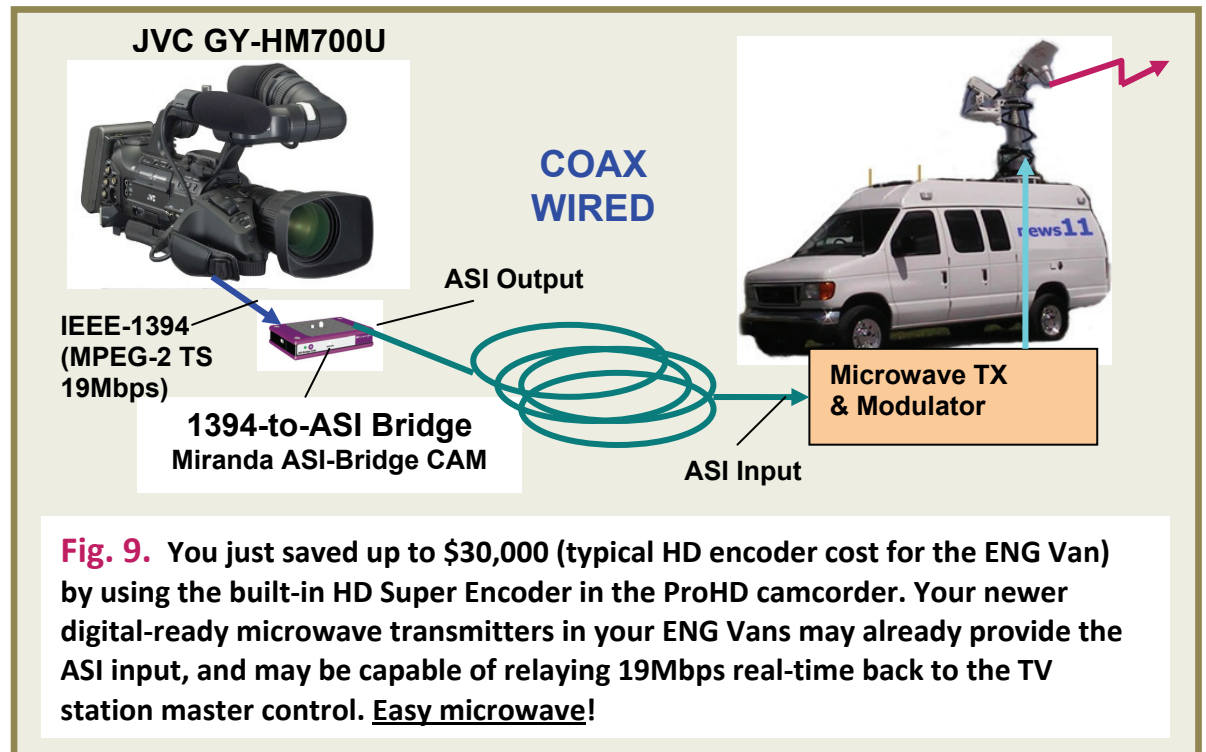
JVC's ProHD GY-HM700, HD250 & HD200 are the only HD camcorders (bar none, as of March 2009) capable of delivering a broadcast quality native full bandwidth 1280x720p60 compressed TS out over 1394 at a bitrate of less than 21Mbps, enabling robust 16-QAM microwave link performance over 8MHz bandwidth.

Live HD ENG backhaul to TV Station

We have established that we can get live HD talking head or action back to the ENG Van by camera-back microwave, or, as we see below, coax wired from the camcorder back to the ENG Van.

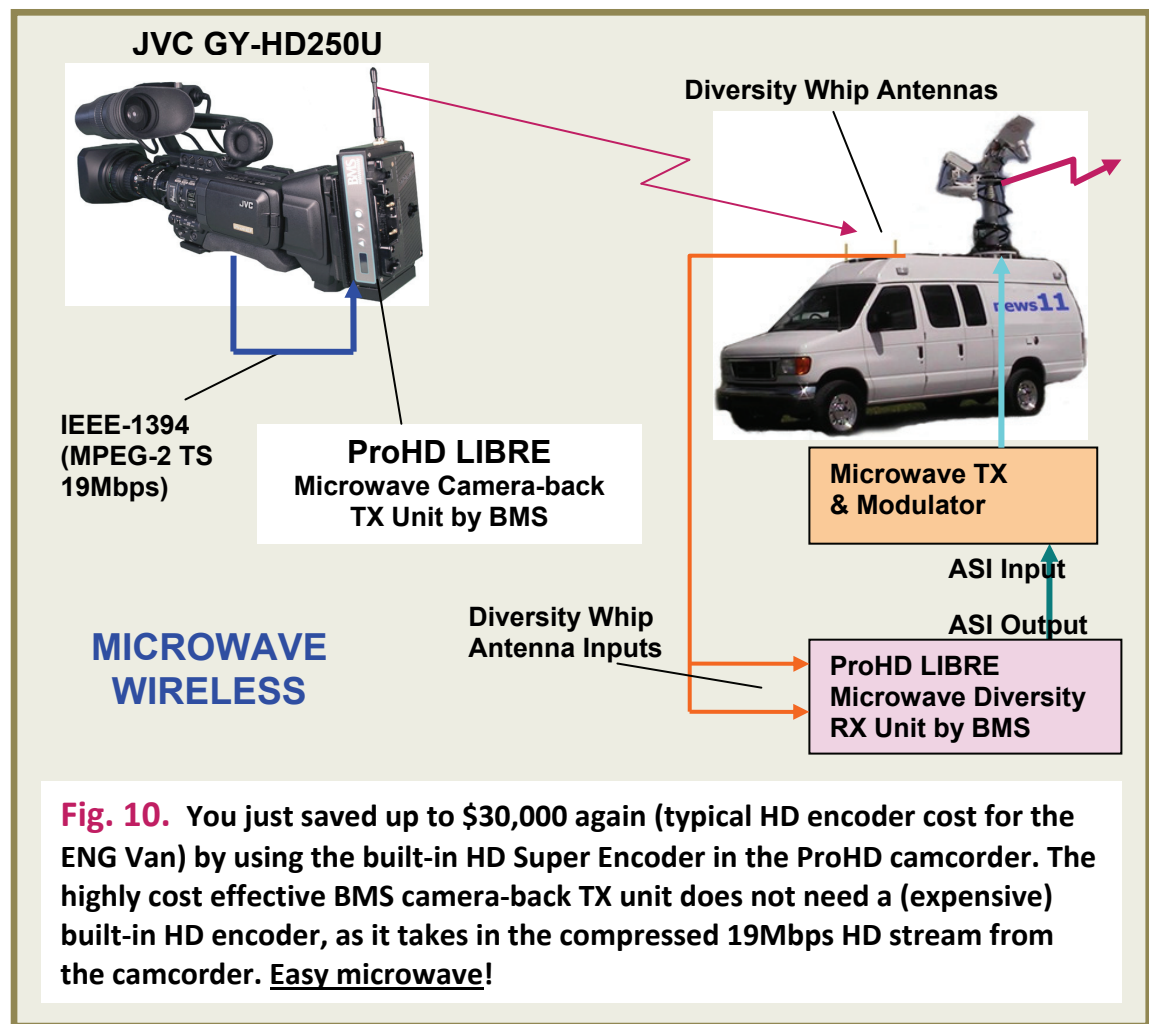
In many Top-100 Markets, backhaul from ENG Van to TV station/Studio is in some cases a "double haul" from the ENG Van (or even helicopter) to one of several regional microwave receiving/relay stations, using 2GHz from the ENG Van to the receiving/relay station, and 7GHz from the relay station back to the TV Station/Studio. Alternatively, some microwave links from relay stations to TV Station/Studio are being replaced by fiber lines and (compressed) HD-over-IP links.

How do you get the LIVE 19Mbps TS from the ProHD camcorder to the ENG Van?



The 1394-to-ASI Bridge unit mounts on the camcorder and accepts 1394 connectivity from the camcorder, converting the 19Mbps MPEG-2 TS to ASI formatted output, easily transported by coaxial cable for hundreds of feet to the ENG Van, where the ASI signal is supplied to the ASI input of your microwave modulator/transmitter. No need for a separate \$30,000 broadcast quality HD encoder.

The BMS Microwave Camera-back unit (LIBRE Transmitter) accepts the 1394 output from the camcorder (MPEG-2 TS at 19Mbps), modulates 16-QAM (or 64-QAM) and transmits COFDM in the 2GHz microwave band (12MHz channel with the 8MHz pedestal and guard bands) to the ENG Van, where a matching BMS Microwave Diversity Receiver (LIBRE Receiver) decodes the modulation and formats the MPEG-2 TS at 19Mbps to ASI output, which is then supplied to your existing (or new) digital Eng Van-to-Studio microwave transmitter's ASI input. You have eliminated the need for that \$30,000 HD encoder in the ENG Van, and your news master control receives a live, broadcast quality full bandwidth native 1280x720p60 signal (or 1920x1080i60). Easy microwave!



What about CODEC latency? The ProHD MPEG-2 Super Encoder compresses the 1280x720p60 using a GOP of 12, which GOP section equals 1/5th of a second or 200mS (12 frames of total 60 frames in a second). 1080i60 (30 frames) use GOP of 15, which GOP section equals 1/2 of a second or 500mS (15 frames of total 30 frames in a second). Total encode/decode latency for ProHD is marginally more than 400mS, quite acceptable in HD ENG even in live remote interviews, while the 1080i60's encode/decode latency of more than one second may be a bit more challenging in live interview situations.

Work flow options inside the ENG Van:

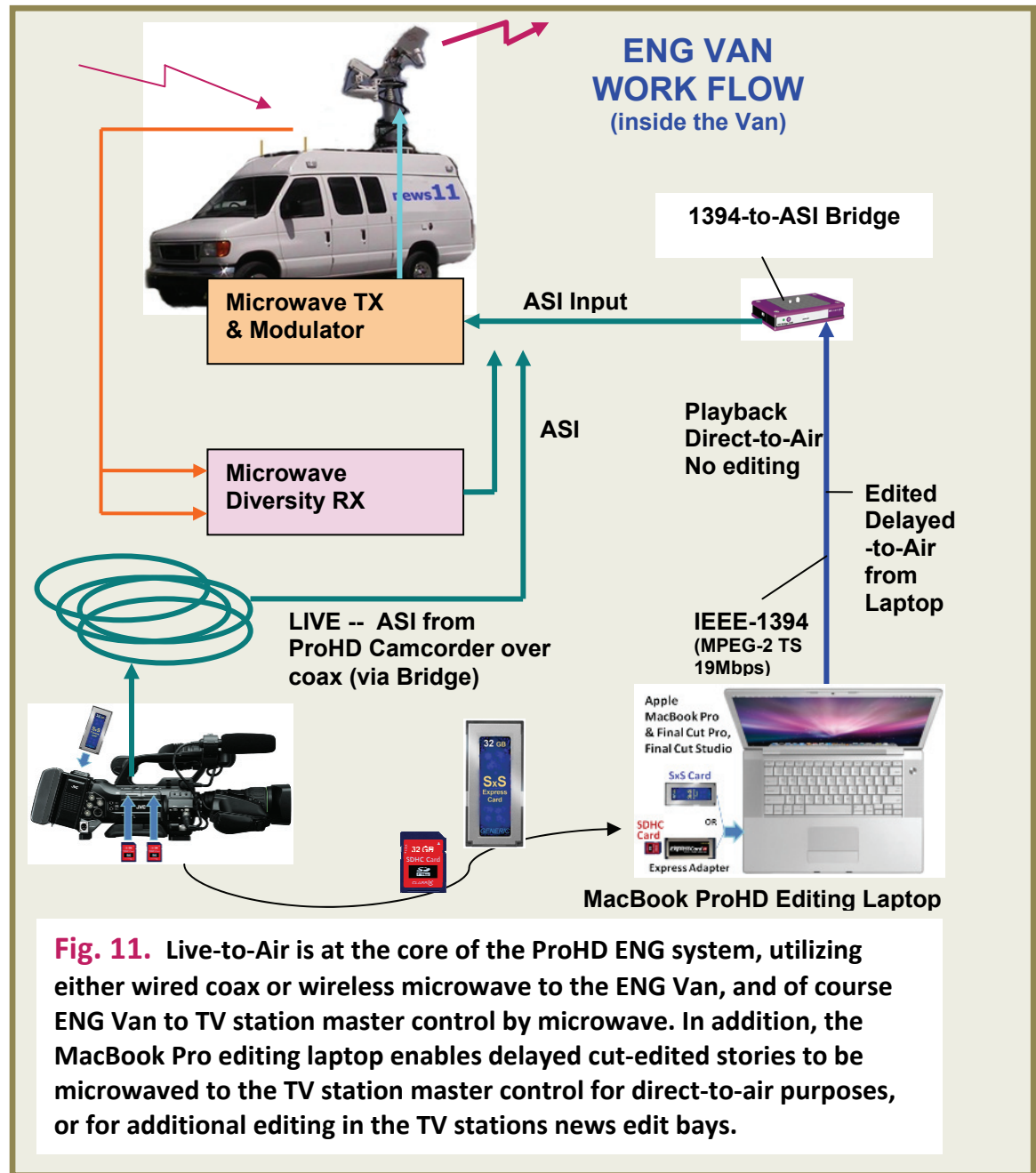


Fig. 11. Live-to-Air is at the core of the ProHD ENG system, utilizing either wired coax or wireless microwave to the ENG Van, and of course ENG Van to TV station master control by microwave. In addition, the MacBook Pro editing laptop enables delayed cut-edited stories to be microwaved to the TV station master control for direct-to-air purposes, or for additional editing in the TV stations news edit bays.

Operational flexibility of the ProHD ENG System includes not only the ENG Van work flow, but also the work flow within TV station infra-structure, striving for an easy conversion from the SD environment to HD and for labor-saving and cost effective work flow. The ingest of ProHD from the field is uncomplicated, whether attaching field hardware or by wireless microwave, and whether going direct-to-air, to news department edit bays or to archive.

Work flow options inside the TV Station:

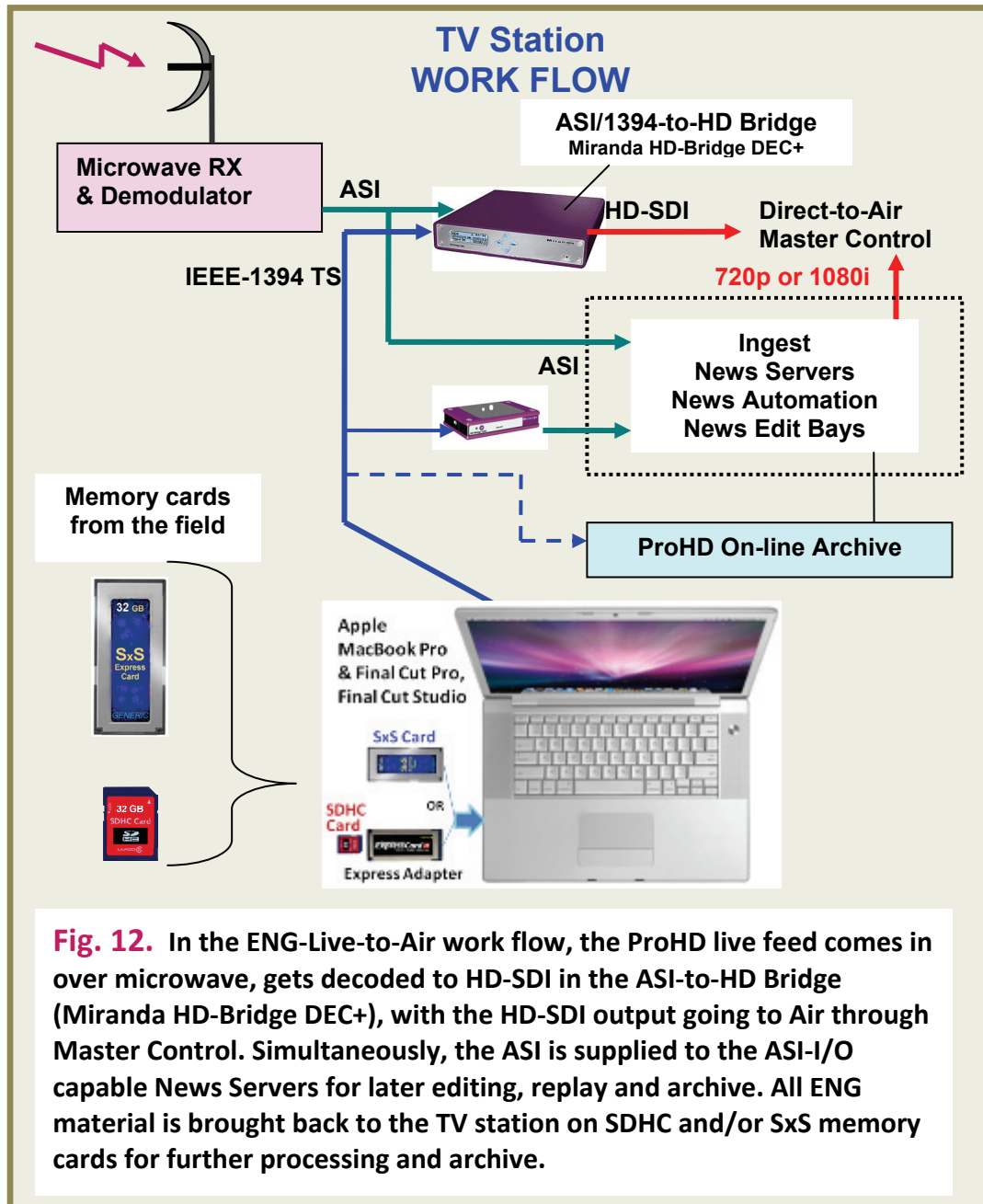
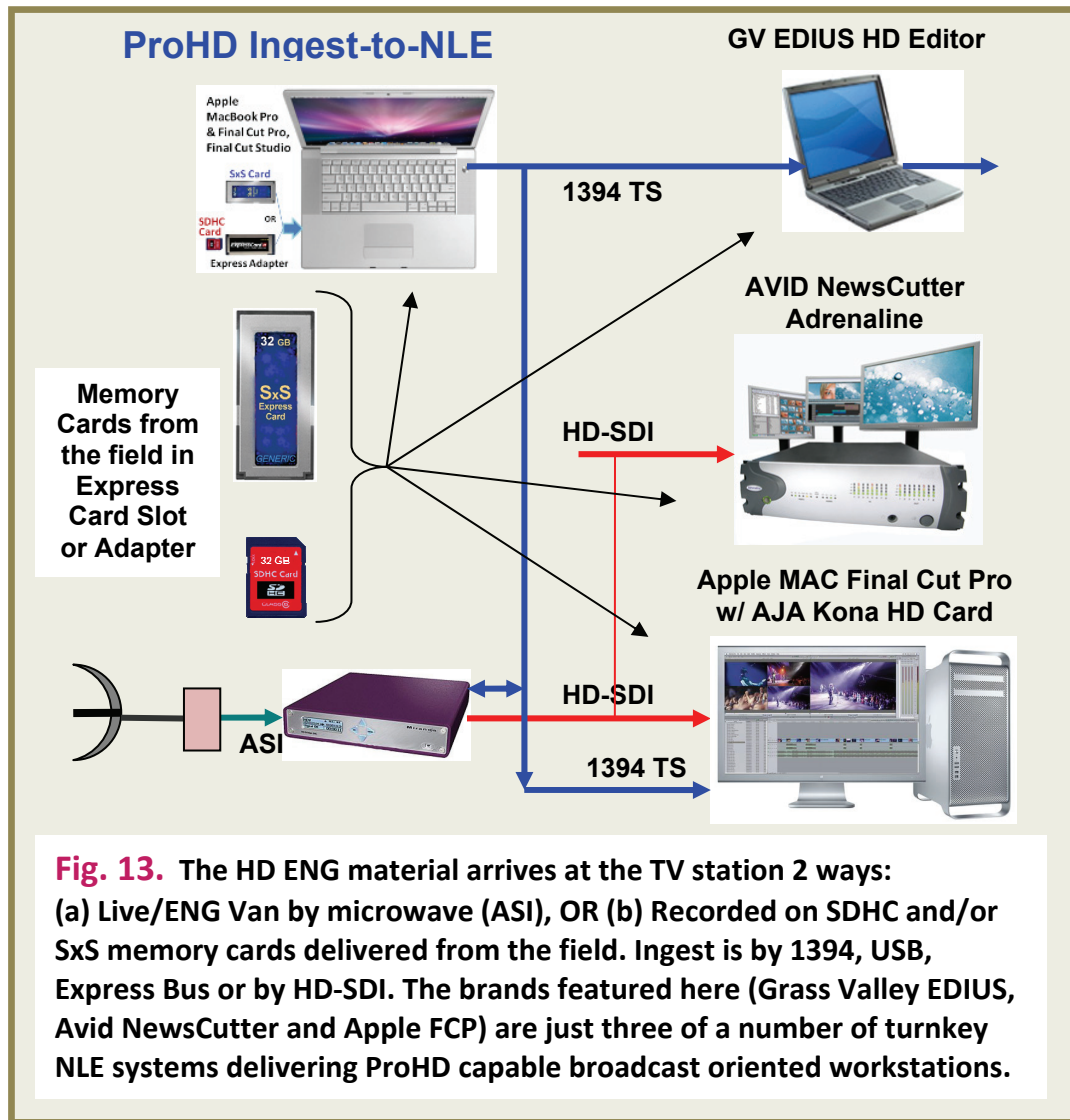


Fig. 12. In the ENG-Live-to-Air work flow, the ProHD live feed comes in over microwave, gets decoded to HD-SDI in the ASI-to-HD Bridge (Miranda HD-Bridge DEC+), with the HD-SDI output going to Air through Master Control. Simultaneously, the ASI is supplied to the ASI-I/O capable News Servers for later editing, replay and archive. All ENG material is brought back to the TV station on SDHC and/or SxS memory cards for further processing and archive.

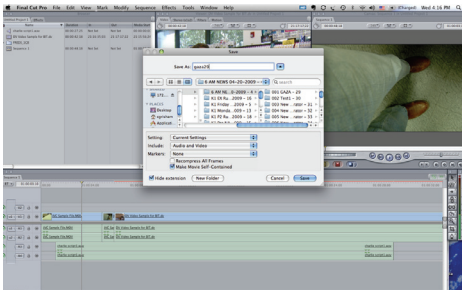
720p or 1080i TV Station? In either case, ProHD is for you. HDTV experts agree that it is considerably easier technologically (and less expensive) to cross convert from 720p (progressive) to high quality 1080i (interlaced) than the other way around. If your station is in the 1080i camp, then you have the option to (i) do all of your HD ENG acquisition and microwave transmission in the ProHD 720p format, including the ingest process at the station, and then convert to 1080i at the station, or (ii) capture and microwave in the ProHD 1080i format. Either way, at the station, the microwave receiver will output the ASI (720p or 1080i) to the ASI-to-HD Bridge and supply a fully 1920x1080i60 or 1280x720p60 compliant HD-SDI with embedded audio and time code out of the Bridge to your existing station infra-structure. The converted or original 1080i will blend seamlessly with your HD news set's 1080i camera acquisition in your routing and switching.

ProHD compatible TV News-oriented Non-linear Editing Systems:



File-based work flow inside the News Automation Server System. Once your 19Mbps ProHD news clips are delivered to the TV station and ingested into the news servers and NLE workstations, the ProHD ENG system has done its job. The ProHD clips (MPEG-2 at 19Mbps) can be utilized for highly attractive low bitrate file-based work flow, but, in some transitions, it may make sense to decode ProHD to HD-SDI and then re-encode upon ingest to the native HD compressed intra-frame format of the news edit and server system, if this will better support your existing work flow and accomplish nearly 0 latency on play-out to air. If you are currently operating NLEs and/or servers with the DVCPRO-HD format, then re-encoding to intra-frame DVCPRO-HD 720p60 when ingesting is an option, but bear in mind that the legacy DVCPRO-HD codec will limit horizontal resolution to 960 pixels luminance and 480 pixels chrominance (from ProHD's 1280 and 640 respectively). Also, the gross real-time bitrate for DVCPRO-HD is about 120Mbps including overheads.

BITCENTRAL supplies TV News Automation Production and Play-out Systems. Bitcentral's "No Barriers Workflow"™ delivers simplified, non-proprietary solutions to content producers. Their MOS-enabled Preci™ news production system allows JVC ProHD customers to use whichever non-linear editor they prefer to edit, publish, and play-out ProHD content quickly and efficiently. The video that is acquired in the field is the same video that is edited, played-out, archived, and shared with other stations via Oasis™. Bitcentral has integrated



MAXedit™ browser-based craft editing within the Preci workflow, enabling users to immediately begin browsing, logging and editing ProHD content from any networked computer, on any platform, with any browser. **Preci includes robust, redundant, native playback of nearly any popular video format, including MXF-wrapped, .MOV and .MP4 files.**

OMNEON delivers a range of HD server products intended for TV broadcast news automation, offering ProHD compatible storage. OMNEON ProHD workflow is also described later in this document under [Live HD ENG Transition Case Study](#).

TELESTREAM's FlipFactory supports a ProHD workflow automation solution for broadcast and cable news, supporting the conversion of ProHD 720p and 1080i transport streams to several other formats upon ingest in a variety of NLEs and servers, including DVCPRO-HD.

ProHD News Archive = Lowest Cost, Fastest Retrieval

Example: A 10TB (10,000GB JBOD) disk array for video applications now sell for less than \$10,000 with ProHD storage capacity of 45,000 minutes or 750 hours of news clips and stories on line. If each clip is an average of 1 minute, that's 45,000 clips on line. And at the low real time bitrate of only 19Mbps per clip enables multiple concurrent reads and writes of clips without bandwidth bottlenecks.

Remote HD POV applications = ProHD

More and more, remote TV cameras are an important part of local news, as a major station in a major market may operate a dozen or more fixed remote locations for traffic and weather. **Do the ProHD camcorders fit that bill? Yes indeed.** Although the ProHD models are camcorders and not just cameras, these models are ideally suited for POV applications, for the following reasons:

- Attractive price-performance ratio
- Full HD resolution native capture of 1280x720p, OR 1920x1080i full resolution output
- Excellent capture of fast freeway traffic with 60 frame progressive
- Streaming output of compressed broadcast quality HD over 1394
- Compressed HD signal is only 19Mbps
- Remote control capability of lens and camera
- Interchangeable lenses –right lens for the application
- Small and light weight for mounting in housing
- 1394-to-ASI/IP streaming converters available

The TrollCam HD Connection. Troll Systems, a leading supplier of complete camera/housing/remote control systems, offers the TrollCam HD system incorporating any of the ProHD camcorders within their NEMA-4 rated camera enclosure, including their “all functionality” remote control unit for camera, lens, pan, tilt and more.



Fig. 14. Troll Systems slogan is “HD at an SD price” integrating the ProHD camcorder models with their TrollCam HD. JVC’s HD200, HD250 and HM700 deliver full HD resolution over wired or wireless.

WiMAX & Fiber IP – Broadband Backhaul for HD ENG

WiMAX is a new wireless digital communications system intended for “wireless metropolitan area networks” (W-MAN). Theoretically, WiMAX can provide broadband wireless access (BWA) up to 30 miles for fixed stations, and 3 - 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 second-generation protocol that allows for more efficient bandwidth use, interference avoidance, and is intended to allow higher data rates over longer distances. WiMAX is expected to be a very well recognized term to describe wireless Internet access throughout the world in the near future. However, much of the talk remains about one way delivery services to consumers (IPTV, mobile video etc.) although it is a fully two-way system.

But, as we can easily recognize, the powerful microwave WiMAX transmitter at the base station may reach for up to 30 miles, a small powerless transmitter in your laptop may only reach part of the way back to the fixed station. Thus, practical implementations may offer a bidirectional reach of one to several miles. A stationary ENG Van may have no problem in connecting upstream, while a moving ENG Van may be more challenging.

Frequency bands are available in the 10-66GHz range for licensed users, while the unlicensed users are delegated to selected areas within the 2-11GHz spectrum. Between Base Stations and fixed users (i.e. homes, offices), the connectivity is the most robust as there are no moving target variables. Between Base Stations and mobile users, the range is severely limited.

WiMAX offers a theoretical bandwidth of maximum 75Mbps. This bandwidth may be achieved using 64QAM 3/4 modulation, but only under optimal transmission conditions. WiMAX supports a wide range of modulation schemes to enable the maximum bandwidth under any specific condition.

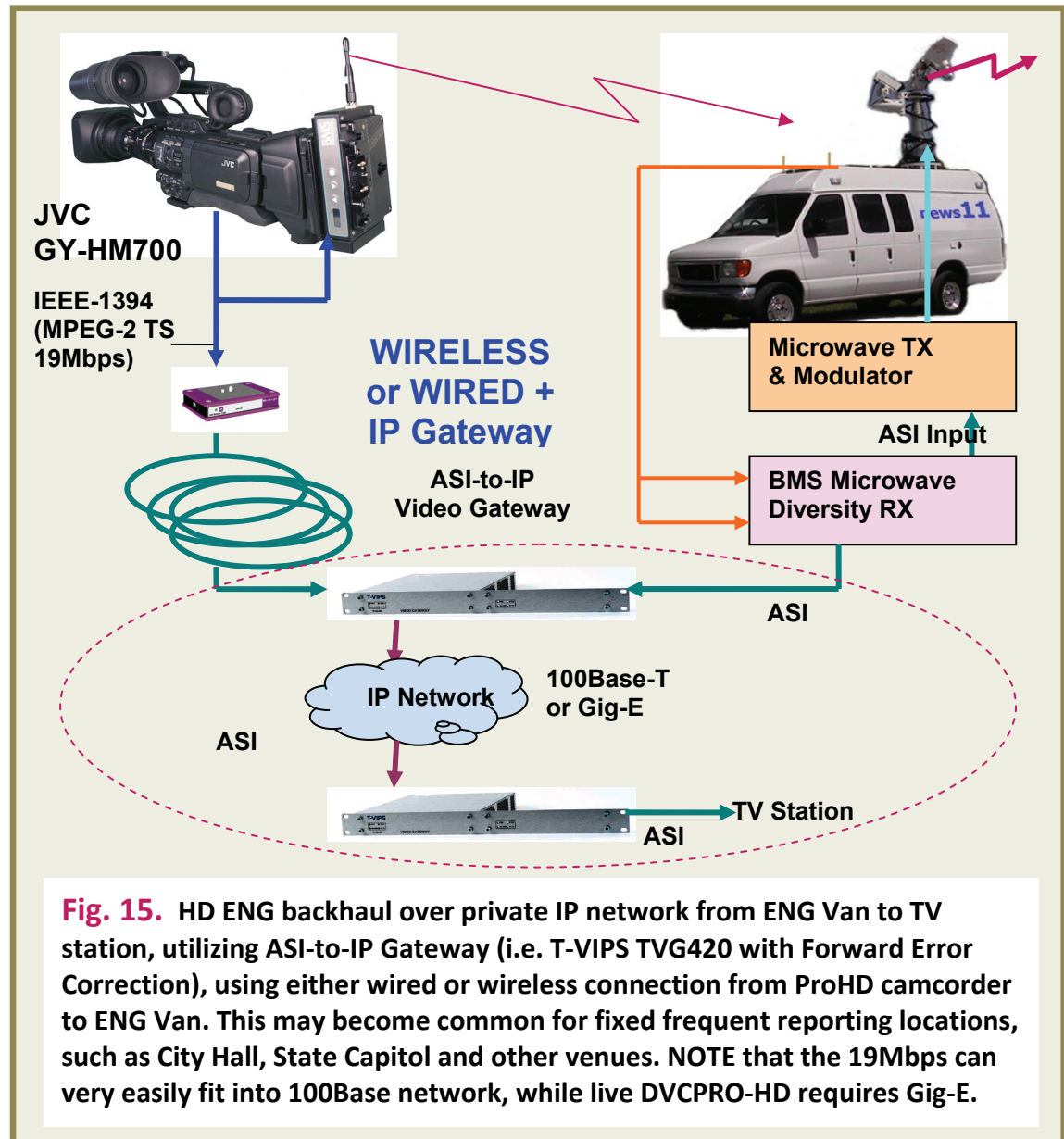
WiMAX offers a theoretical maximum range of 30 miles with a direct line of sight. Near-line-of-sight (NLOS) seriously limits the range. In addition, some of the frequencies utilized by WiMAX are subject to rainfade interference. The unlicensed WiMAX frequencies are subject to RF interference from competing technologies and competing WiMAX networks.

Is WiMAX suitable for HD ENG? Most certainly, but there are many issues to be covered before the WiMAX backhaul becomes an every-day event. The bottom line question is the required bitrate for the backhaul, and, at 19Mbps, ProHD is the most attractive professional HD compression scheme for WiMAX applications. But even at 19Mbps, the ENG backhaul would occupy a rather large part of the total WiMAX bandwidth probably requiring using the licensed WiMAX band for real-time guaranteed performance. Therefore, the 2GHz BAS and 7GHz point-to-point microwave bands currently used by the TV broadcasters are likely to be the most practical solution for HD ENG wireless backhaul for several years to come.

The much talked about live video-casts over WiMAX in 2009 is really for sub-SD (sub standard definition) video quality in the opinion of professional TV broadcasters. It is not realistic to plan live broadcast quality HD backhaul via WiMAX for ENG use for several years to come, in our opinion.

Fiber-wired IP backhaul

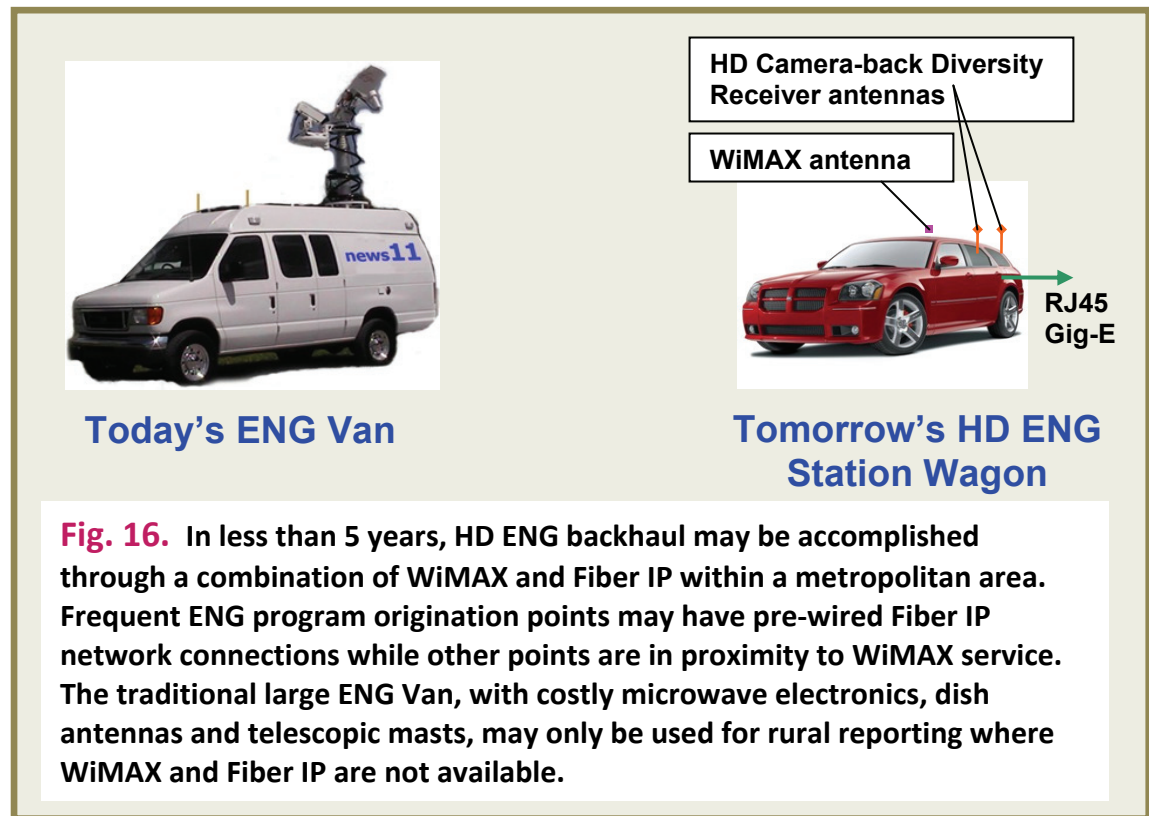
“Dark” fiber-optic cable is generally available criss-crossing metropolitan areas all over North America, which can be leased and “lit” for cost effective backhaul of HD ENG and HD POV (Point-of-View) cameras.



The TV station can lease a dedicated fiber connection and just use a fiber line transmitter and receiver, or, in the event of multiple POV cameras (traffic cams) and multiple fixed ENG Van connection points (city hall, federal building, arenas etc.), IP connectivity can be leased from local private IP network operators based on bandwidth requirement. **With bandwidth requirement per origination point of only 19Mbps, ProHD is ideally suited for such applications.**

Microwave, Fiber IP or WiMAX?

2GHz BAS and 7GHz microwave links are here to stay for years. Fiber IP is being deployed more and more as you read this. WiMAX is on the horizon. The potential savings are substantial if a TV Station can eliminate (or greatly reduce) the use of ENG Vans with link-to-studio microwave, perhaps replacing the majority of ENG Vans with mini-vans or even station wagons. The HD ENG Station Wagon just requires the HD ENG camcorder, the MacBook FCP editor laptop, and a minimum number of Fiber IP terminals, support equipment and cables. A complete HD ENG Station Wagon for less than \$100,000?



Change is inevitable – Keep your options open . . .

Live HD ENG makes you highly competitive . . .

ProHD makes your HD News highly cost effective . . .

Lenses for HD ENG

Professional ENG requires interchangeable lenses. The SD 4:3 experience is that the average ENG shoot requires a mild wide angle lens, while distant action may require a relatively powerful telephoto lens. The GY-HM700 NEW standard HD lens (Canon KT14x4.4KRSJ), 20% wider than the current standard GY-HD250 lens, offers an exceptional good compromise between wide angle and telephoto, and it is highly cost effective when packaged with GY-HM700 camcorder at a US list of \$7,995 (GY-HM700 including the lens). One of four other optional lenses is the Fujinon HTs18x4.2BRM fitted with Fujinon's DigiPower servo system, offering outstanding HD performance at a package US list price of \$11,739 (lens only), a true 2/3-inch internal design with built-in 1/3-inch mount.

Lens Parameters	JVC GY-HM700 w/ CANON 1/3-inch KT14x4.4KRSJ	JVC GY-HM700 w/ Fujinon 1/3-inch HTs18x4.2BRM
US list price ProHD camcorder including interchangeable lens	\$7,995	\$18,734 (Lens USMSRP \$11,739)
Zoom Ratio	14x	18x
Range Focal Length	4.4 – 61.6 mm	4.2 – 76 mm
Angular Field of View 16:9 H x V Degrees	~60 x ~35 ~5 x 2.5	~63 x ~37 ~4 x ~2
Max Relative Aperture	1.6	1.4
Min Aperture	f/16	f/16
MOD	<1 meter	0.6 meter
½-inch & 2/3-inch lens adapters (optional)	Yes	
Focus assist (not auto focus)	Yes	
Built-in ND filters	Yes (2 on body)	

Fig. 17. This table shows the flexibility of the GY-HM700 camcorder with the NEW standard Canon lens and an optional high performance Fujinon lens. The standard Canon KT14x4.4KRSJ offers good HD ENG wide angle performance indicated by 4.4 mm focal length and 60 degrees horizontal angular field of view and 14x zoom. The optional Fujinon HTs18x4.2BRM is only 3 degrees wider at 63 degrees but with a more powerful 18x zoom. JVC also offers a wide angle converter (WCV82SC about \$500) to fit most standard lenses.

Besides the two lenses listed in the above table, five additional 1/3-inch lenses are available.

SD lenses on HD camcorders?

A TV station generally owns large quantities of SD lenses, some even purchased recently. However, most of these lenses are ½-inch and 2/3-inch, and thus require lens adaptors to fit on the 1/3-inch camcorders. JVC does offer both ½-inch and 2/3-inch lens adaptors for the ProHD camcorders. There are two primary problems associated with using SD lenses on HD camcorders:

Chromatic aberration in the lens is (simplistically) that a beam of light containing different colors (as any light ray is made up of the primary colors) diffract differently through a lens element, like light is split into the primary colors by a prism. In an extreme case example, a pixel-size light ray (containing red, green and blue components) going through a lens element is diffracted into three beams of red, green and blue, and thus being “out of registration” before entering the camera front end. With HD being 6x the area resolution of SD, chromatic aberration (CA) is much more challenging in HD, and the lens manufacturers take great care in the design and the manufacture of HD lenses to reduce the CA to a minimum. SD lens design were of course performed to a SD standard with respect to CA, therefore the official recommendation is not to use SD lenses on HD camcorders. CA is particularly observable at object edges in the image, with perhaps a spurious color edge being visible in contrasted transition from light to dark or dark to light, due to the “out of registration” color separated pixels.

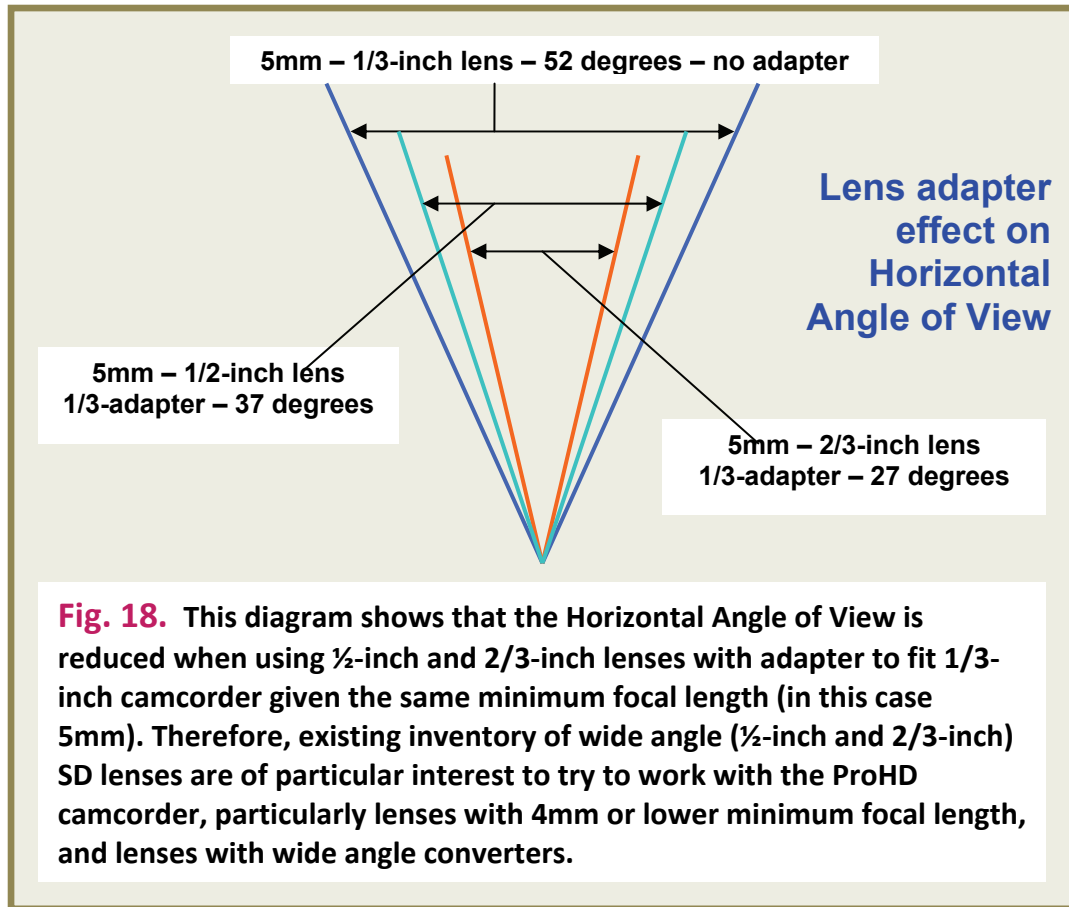
Longitudinal chromatic aberration happens as the light beams travel through the lens, and, not surprisingly, CA gets worse with longer focal lengths (at telephoto settings).

Lateral chromatic aberration is measured from lens center out toward the edges, as it is impossible to maintain lens center CA performance as one approaches the lens edge. In the question of using SD lenses on HD ENG camcorders, these CA problems may not be sufficiently adverse to prevent the use of SD lenses, as most ENG stand-up remote reporting only uses the middle of the 16:9 screen for the talent and uses a wide lens setting rather than telephoto.

Lens adaptor multiplier effect. The ProHD camcorders use 1/3-inch imager where optimum matched lenses are also 1/3-inch. The use of lens adaptors of ½-inch-to-1/3-inch and 2/3-inch-to-1/3-inch produces the effect of “multiplying” the 1/3-inch focal length (reducing the angle of view). In the ProHD camcorders, a 1/3-inch lens with a focal length of 5mm produces a horizontal angle of view of 52 degrees (a relatively wide angle).

Using a ½-inch lens (with a native minimum focal length of 5mm) with the adaptor increases the focal length by a factor of 1.43 to 7mm, producing a horizontal angle of view of approx. 37 degrees, which may be acceptable in HD ENG.

Using a 2/3-inch lens (with a native min focal length of 5mm) with the 1/3-inch adaptor increases the focal length by a factor of 1.97 to 10mm, producing a horizontal angle of view of approx. 27 degrees, which may not be wide enough for HD ENG.



The bottom line using SD lenses in ProHD camcorders? If you have ½-inch and/or 2/3-inch SD lenses already in your inventory, then you owe it to yourself to try them out on your ProHD camcorders. The US list price for the GY-HM700 without any lens is \$6,995 and only \$1,000 more (\$7,995) with the NEW standard professional Canon HD 14x lens. Depending upon your SD lens inventory (1/2-inch or 2/3-inch), add the ½-inch (JVC ACM-12) or 2/3-inch (JVC ACM-17) lens adapter for about \$750. Shoot the same ENG test footage with the standard HD and the existing inventory SD lens, view the material (preferably) on a studio monitor with full native HD pixel resolution. You may perhaps decide that your HD ENG efforts may be sufficiently served for an initial period of time using some of the existing inventory SD lenses, limiting your initial investment. In the longer term, real HD lenses are required to provide optimum image quality and acquisition flexibility.

CASE STUDY

Top-20 Market

Live HD ENG

Transition

Successful transition to Live HD ENG

WXYZ Ch. 7 in Detroit, a Scripps TV station in the 11th largest market in the US, was the first station in Detroit to regularly broadcast live HD news from a studio set. This case study is about WXYZ's planning, engineering and testing their capability to implement full HD ENG, live and delayed, contributing to WXYZ's multiple daily HD newscasts.



WXYZ's Digital workflow began in 2004 using DV cameras with Focus DTE drives, based on speed and quality, to match or better the speed of tape "butt" editing systems. DTE edit functionality allows instant access to all clips with no "flipping" or transferring of data. Using JVC HD camcorders and Final Cut Pro with Apple laptops, WXYZ achieved every major goal.

Transition Goals

Maintain or improve workflow efficiency

WXYZ has already been operating in the DV domain with SD ENG, including an extensive non-linear workflow supported by an EMC SAN and Omneon news play-out servers, with editing accomplished by networked MAC workstations running Final Cut Pro. It was essential that the non-linear workflow was maintained.

Achieve "true HD" live ENG image quality

As the premiere TV station in Detroit, WXYZ needed to achieve TRUE HD ENG image quality, which could be intercut with their high quality HD news set without the large majority of the (HDTV set equipped) audience seeing any difference between studio HD and field HD quality.

Quick & trouble-free cut-over from SD to HD

Obviously, WXYZ wanted to utilize their newer existing SAN, servers and networked editors and graphics workstations, to achieve a quick and trouble-free cut-over from SD to HD ENG, ideally using compressed HD format which did not exceed the DV bitrate of 25Mbps.

Maintain future investment flexibility & options

This was NOT to be a "low cost" compromise, but WXYZ recognized the benefit resulting from a highly cost effective total live HD ENG implementation in 2008, giving future opportunities to go back to senior management for additional funding in 2009 and beyond to respond to competitive pressures and new news delivery facilities if and when required.

Eliminate older technologies (i.e. video tape)

WXYZ had little interest in tape, as their newer archive is entirely server-based. At 25Mbps or lower bitrate, the news clips take up very little disk-space, making server-based archive affordable and technologically easier to accomplish.

Challenges

Explore existing work flow “compatible HD format”

There are many compressed HD formats out there: Sony XDCAM EX at 18, 25 & 35Mbps, and HDV at 19 & 25 – Panasonic AVC-I at 50Mbps and 100Mbps, & DVCPRO-HD at 100Mbps – Thomson, AVID, Ikegami, Hitachi, and others. Most of these formats have excessive bitrates for WXYZ purposes, as is explained below. And the ones with bitrates at or below the 25Mbps limit were not compatible with the workflow connectivity with DTE (Direct-to-Edit) capability needed in the field, even with new Flash RAM memory cards. WXYZ closely examined JVC’s ProHD 720p60 format at 19 Mbps compressed HD stream output, and, after exhaustive test and trials, settling on ProHD as the format to be implemented.

Utilize new ENG BAS microwave channels for HD?

In short, the new digital 12MHz BAS 2GHz channels can really only work reliably for maximum 21Mbps stream, thus JVC’s ProHD stream at 19Mbps is the only WXYZ workflow-compatible HD format which may feed directly in to the ENG trucks’ NEW digital microwave modulators and transmitters.



Eliminate expensive HD encoders in the ENG Trucks?

With HD camcorder output bitrates in excess of 21Mbps, the solution is to purchase an HD Encoder for each ENG truck, supply HD-SDI from the camcorder and get 21Mbps or less ASI wrapped stream out to the microwave modulator, at a cost of some \$20,000 to \$30,000 per truck. WXYZ saved around \$300,000 by using the built-in Super-encoder in the JVC ProHD camcorders. Eliminating the need to buy new HD encoder units or to buy new microwave modulator/transmitters with built-in HD encoders which are also rather expensive.

Finding Ideal Solutions

Finding the “ideal” HD camcorder: JVC GY-HD250U

WXYZ tested several popular models of professional HD ENG camcorders, including major brands with flash memory cards and optical disc recording, some more than twice the price of the HD250U including lens. No other HD camcorder was able to match the speed of workflow of the ProHD format and the GY-HD250U camcorders.

- Full HD resolution front-end
- Interchangeable ENG lenses
- Built-in Super-encoder ~19Mbps
- Live output direct to microwave modulator (ENG truck-based, through inexpensive ASI converter)
- Live output direct to DTE Recording Unit
- Acquires broadcast quality HD video
- Optional Camera-back Microwave TX Unit

Explore cost effective ENG laptop editors and utilize compatible news room editors: Apple MacBook Pro with FCP

Only one combination of HD NLE and HD editing software matched the speed of the workflow already achieved with the earlier DV implementation: MacBook Pro laptop with Final Cut Pro editing application for the ENG vans.

- Full HD resolution editing (720p60)
- DTE – NO transfer needed to edit
- Native ProHD stream-handling ~19Mbps
- Clip output direct to microwave modulator (ENG truck-based, through inexpensive ASI converter)
- Clip output direct to DTE Recording Unit
- Produces broadcast quality HD clips



Success: Live HD ENG Operation

- Full HD resolution from LIVE ENG
- Very fast workflow
- No excessive CODEC cycles
- Greatly reduced tape handling
- All future archive is on-line
- AND ... reduced investments

APPENDIX

DMA Top-100

TV Markets

U.S. TV Household Estimates Designated Market Area (DMA) — Ranked by Households

Source: Nielsen Media Research, Inc. Nielsen Station Index (NSI)

Rank	Designated Market Area (DMA)	TV Households	% of US
1	New York, NY	7,433,820	6.495
2	Los Angeles, CA	5,654,260	4.94
3	Chicago, IL	3,492,850	3.052
4	Philadelphia, PA	2,950,220	2.578
5	Dallas-Ft. Worth, TX	2,489,970	2.175
6	San Francisco-Oakland-San Jose, CA	2,476,450	2.164
7	Boston, MA (Manchester, NH)	2,409,080	2.105
8	Atlanta, GA	2,369,780	2.07
9	Washington, DC (Hagerstown, MD)	2,321,610	2.028
10	Houston, TX	2,106,210	1.84
11	Detroit, MI	1,926,970	1.684
12	Phoenix, AZ	1,855,930	1.622
13	Tampa-St. Petersburg (Sarasota), FL	1,822,160	1.592
14	Seattle-Tacoma, WA	1,819,970	1.59
15	Minneapolis-St. Paul, MN	1,730,530	1.512
16	Miami-Fort Lauderdale, FL	1,546,920	1.352
17	Cleveland-Akron (Canton), OH	1,524,930	1.332
18	Denver, CO	1,524,210	1.332
19	Orlando-Daytona Beach-Melbourne, FL	1,466,420	1.281
20	Sacramento-Stockton-Modesto, CA	1,399,520	1.223
21	St. Louis, MO	1,249,820	1.092
22	Portland, OR	1,175,100	1.027
23	Pittsburgh, PA	1,156,460	1.01
24	Charlotte, NC	1,122,860	0.981
25	Indianapolis, IN	1,114,970	0.974
26	Baltimore, MD	1,102,080	0.963
27	Raleigh-Durham (Fayetteville), NC	1,080,680	0.944
28	San Diego, CA	1,066,680	0.932
29	Nashville, TN	1,016,290	0.888
30	Hartford & New Haven, CT	1,014,990	0.887
31	Kansas City, MO	937,970	0.819

32	Columbus, OH	925,840	0.809
33	Salt Lake City, UT	919,390	0.803
34	Cincinnati, OH	915,570	0.8
35	Milwaukee, WI	905,350	0.791
36	Greenville-Spartanburg, SC-Asheville, NC-Anderson, SC	858,050	0.75
37	San Antonio, TX	818,560	0.715
38	West Palm Beach-Ft. Pierce, FL	779,430	0.681
39	Grand Rapids-Kalamazoo-Battle Creek, MI	741,420	0.648
40	Birmingham (Anniston and Tuscaloosa), AL	739,750	0.646
41	Harrisburg-Lancaster-Lebanon-York, PA	738,880	0.646
42	Las Vegas, NV	728,410	0.636
43	Norfolk-Portsmouth-Newport News, VA	718,020	0.627
44	Albuquerque-Santa Fe, NM	689,120	0.602
45	Oklahoma City, OK	687,300	0.6
46	Greensboro-High Point-Winston Salem, NC	685,110	0.599
47	Jacksonville, FL	674,860	0.59
48	Memphis, TN	673,770	0.589
49	Austin, TX	667,670	0.583
50	Louisville, KY	667,230	0.583
51	Buffalo, NY	631,120	0.551
52	Providence, RI-New Bedford, MA	622,580	0.544
53	New Orleans, LA	602,740	0.527
54	Wilkes Barre-Scranton, PA	594,570	0.519
55	Fresno-Visalia, CA	574,900	0.502
56	Little Rock-Pine Bluff, AR	567,060	0.495
57	Albany-Schenectady-Troy, NY	556,750	0.486
58	Richmond-Petersburg, VA	550,240	0.481
59	Knoxville, TN	547,930	0.479
60	Mobile, AL-Pensacola (Ft. Walton Beach), FL	537,810	0.47
61	Tulsa, OK	529,540	0.463
62	Ft. Myers-Naples, FL	509,530	0.445
63	Lexington, KY	503,260	0.44
64	Dayton, OH	483,790	0.423
65	Charleston-Huntington, WV	479,750	0.419
66	Flint-Saginaw-Bay City, MI	465,790	0.407
67	Roanoke-Lynchburg, VA	461,420	0.403
68	Tucson (Sierra Vista), AZ	456,030	0.398
69	Wichita-Hutchinson, KS Plus	450,930	0.394
70	Green Bay-Appleton, WI	444,210	0.388
71	Des Moines-Ames, IA	432,410	0.378
72	Honolulu, HI	429,940	0.376
73	Toledo, OH	425,890	0.372
74	Springfield, MO	421,960	0.369

75	Spokane, WA	416,630	0.364
76	Omaha, NE	411,520	0.36
77	Portland-Auburn, ME	410,890	0.359
78	Paducah, KY-Cape Girardeau, MO-Harrisburg, IL	393,260	0.344
79	Columbia, SC	393,170	0.343
80	Rochester, NY	390,590	0.341
81	Syracuse, NY	388,000	0.339
82	Huntsville-Decatur (Florence), AL	386,520	0.338
83	Champaign & Springfield-Decatur, IL	386,000	0.337
84	Shreveport, LA	385,770	0.337
85	Madison, WI	378,740	0.331
86	Chattanooga, TN	366,780	0.32
87	Harlingen-Weslaco-Brownsville-McAllen, TX	349,910	0.306
88	Cedar Rapids-Waterloo-Iowa City & Dubuque, IA	346,330	0.303
89	South Bend-Elkhart, IN	334,720	0.292
90	Jackson, MS	334,650	0.292
91	Colorado Springs-Pueblo, CO	334,390	0.292
92	Tri-Cities, TN-VA	332,840	0.291
93	Burlington, VT-Plattsburgh, NY	331,320	0.289
94	Waco-Temple-Bryan, TX	329,690	0.288
95	Baton Rouge, LA	326,390	0.285
96	Savannah, GA	319,160	0.279
97	Davenport, IA-Rock Island-Moline, IL	309,600	0.27
98	El Paso, TX	308,080	0.269
99	Charleston, SC	307,610	0.269
100	Ft. Smith-Fayetteville-Springdale-Rogers, AR	297,920	0.26

Please contact JVC Professional for additional information and product demonstrations:

JVC Headquarters & East Coast Sales (973) 317-5030

JVC West Coast Sales (714) 527-7500

<http://pro.jvc.com>

ProHD

