



# SELECTING VIDEO DEVICES FOR USE WITH DARTFISH

Today, there is a bewildering range of devices capable of creating video ; camcorders, webcams, phones, gaming consoles and so on. Even within the camcorder range there are camcorders that record onto tape, memory card or hard drive. Then, there is a further decision to take - a High Definition (HD) camcorder or not ?

The decision is even more complicated because there are specific requirements for an efficient use of Dartfish software tools.

The purpose of this document is to help you purchase a camcorder (or other imaging device) that will give you the best quality results, and therefore the best experience, using Dartfish software for your sport/activity. It will give you some technical facts and simple explanations about different types of device available on the market.

**IMPORTANT NOTE:** This document was written for Dartfish version 5.0. This version introduced compatibility with a wider range of video formats and new video import tools. Some features and capabilities described here are not available on older versions.

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## DARTFISH RECOMMENDS

### LET'S START BY JUMPING TO THE BOTTOM LINE

To get the most from both the live and post-recording features of Dartfish software, you should use a camcorder recording onto tape.

[\*More about using Dartfish\*](#) (see page 5)

[\*More about tape camcorders\*](#) (see page 12)

If you don't use the live action features of Dartfish, you might prefer to use a tapeless camcorder because the transfer time of recorded video files to the computer is significantly faster.

[\*More about using Dartfish post-recording\*](#) (see page 6)

[\*More about hard drive and flash drive camcorders\*](#) (see page 14)

There is no doubt that High Definition (HD) video gives better image quality and a High Definition Video (HDV) tape camcorder will best suit all the possibilities that Dartfish offers. However, you should be aware that HD files are bigger and require a more powerful computer to process. In order to have the most flexibility, an HD device that offers a Standard Definition (SD) mode would be the best.

[\*More about HD\*](#) (see page 8)

Read on to find out why we make these recommendations and learn more about the different types of video device that we do and don't recommend.



# ENOUGH TECH TALK TO GET YOU STARTED

## RECORDING MEDIA AND VIDEO STREAMING

Until recently, digital camcorders only recorded onto tape cassettes, but now there are also camcorders that use hard drives similar to that of your computer, or flash memory cards like those used by digital cameras, or DVDs that can be played back directly in a DVD player.

Webcams don't record video, they "stream" it to the computer, which then displays or records the images. However some types of camcorder can also stream video directly to a computer without the need to record onto media inside the camcorder.

### *What you need to know:*

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- Features of Dartfish that record or display video 'Live' require a camera capable of streaming.
  - Only tape camcorders can currently stream digital video.
  - Analogue to digital converters can be used to convert the analogue output that most camcorders offer.
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## VIDEO ENCODING

Almost all video devices encode video so that the data takes less space to store and can be processed more efficiently. Historically, tape camcorders use DV video but Flash card and hard drive camcorders use MPEG-2 or MPEG-4. USB webcams don't encode video at all and furthermore, the frame rate is low and the image size small to accommodate for the USB link capacity. Mobile phones often use 3GP file format. This is a huge oversimplification of this topic but it is enough to get you started.

### *What you need to know:*

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- Dartfish can play video encoded as AVI, WMV, MPEG-2, MPEG-4.
  - Dartfish supports Quicktime files encoded in MPEG-4 (AVC/H.264) as well as .3GP file format.
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## FRAME RATE

The frame rate is the number of pictures a device takes in a single second. It is expressed in the form: "XX fps" (frames-per-second). The frame rate of personal camcorders is not only dependant of the device itself, but of the country where it was bought:

North & South America, Korea, Japan (NTSC) – frame rate: 29.97 fps

Europe, China, rest of the World (PAL) – frame rate: 25 fps

Other devices don't use these standard PAL or NTSC based frame rates; Some devices use lower frame rates, usually to reduce the amount of data. It is also possible to buy specialist high frame rate camcorders of 100fps and because there are more images per second, these devices are suitable for observing the detail of rapid movement.

### *What you need to know:*

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- Normally you will buy a device with the frame rate of the norm for your country: NTSC or PAL. Dartfish will play both.
  - Low frame rate camcorders may not show the detail required when observing video frame by frame. Their usefulness depends on what detail you need to see and how rapidly the observed object moves.
  - Dartfish can read video files produced with high speed camcorders but compatibility first needs to be checked (contact Dartfish Support).
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## PICTURE SIZE & HIGH DEFINITION (HD)

Picture size is the size of each video frame expressed in the form: "WIDTH x LENGTH Pixels". In theory, the higher the picture size is, the better it is: the number of pixels expresses the definition of the picture/movie, and therefore its quality. Buyer beware! The megapixel rating that some cameras boast on the packaging relates to the still picture image size or definition but for PAL camcorders the Standard Definition (SD) image size is 720 x 576 and NTSC is 720 x 480.

There are also HD camcorders with an image size of (for example) 1440 x1080. Consequently, HD results in a much sharper image but also notice that the ratio of width to height is also different; HD is "widescreen" (16:9 ratio). Note that DV SD can also be 16:9 whereas HD is exclusively 16:9.

### *What you need to know*

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- Normally you will buy a device with the standard, NTSC or PAL, from your country so your choice is whether you want SD or HD.
  - When buying a device that creates a lower than standard picture size, remember that it will have an effect on the image quality.
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## USING CAMCORDERS IN DARTFISH

Dartfish software is intended to facilitate the use of video as part of an instructional process. To do so you will want to be able to use video efficiently, therefore one of the most fundamental choices you must make when choosing a camcorder is “What devices work best when using Dartfish?”. That leads to a second question: “What Dartfish features will I use?”

There are three main ways of working with Dartfish:

1/ InTheAction 2/ Live tagging 3/ Post-performance analysis.

Here is some advice to help you choose the right camera for each situation.

### INTHEACTION

This is the tool that offers “action replay” of a performance straight after it has happened. To achieve this, the camcorder “streams” live images directly to Dartfish via a “firewire” cable. When recording is activated, the software saves the image as a video file then automatically displays what it has recorded. The video is saved and stored by the computer, making it unnecessary to record onto the tape in the camcorder.

A second way of using InTheAction is Live Delay. Again video is streamed to the computer but only displayed after a user defined delay. This time, no files are created and the computer functions as a mirror to the action that the camcorder has witnessed.

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- InTheAction therefore requires a device that can stream video.

### LIVE TAGGING

Tagging; a tool found in the TeamPro and Connect Plus Editions of Dartfish, is used to create an index of the content within longer video clips. Particular events of interest in a game can be recalled and displayed when using this index. The user can “tag” a video live, where camcorder images are streamed directly to the computer.

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- Like InTheAction, Live Tagging therefore requires a device that can stream video.  
We recommend the following types of cameras for InTheAction and Live Tagging.

Digital Video (DV) camcorder – This type of camera will allow you to do live SD streaming with its IEEE1394 firewire output.

High Definition Video (HDV) camcorder - This type of camera will allow you to do live SD or HD streaming with its IEEE1394 firewire output.

If a tapeless camcorder is otherwise preferred, a compromise solution is to stream via the analogue output. Most camcorders have these for playback directly to a television. An analogue to digital converter then creates a digital stream that can be used by Dartfish.

[\*More about this...\*](#) (see page 17)



## TAG VIDEO CLIP

Where it is impractical or impossible to use Live Tagging, Dartfish also lets you tag video files. Dartfish's DV Import tool records the video file where a camcorder using DV tape has been used. There are other tools to import from other types of media: Flash cards, Memory Sticks, Hard Disk Drive (HDD) camcorders, DVDs etc.

Preference is given to camcorders with HDD, Flash memory cards or even DVD media because these cameras would allow a much faster transfer time than camcorders using miniDV tapes, since tapes need to be played back at their original speed.

Tactical analysts may prefer the "wide screen" 16:9 aspect ratio offered by SD and one of the HD formats because it is possible to see more of the width of the playing area in a single shot.

## OTHER POST-PERFORMANCE ANALYSIS TOOLS

The choice of the camcorder recording medium for the analysis of video files on your computer's hard drive is less clear cut: The transfer time of video files from an HDD camcorder is much quicker but a new video file is created each time recording is stopped and extra work may be required post-import to trim the video or find what you need. Note that merging and renaming files at import will be supported in the Dartfish version 5.1. By contrast, although taped footage can only be recorded to your computer in real time, Dartfish tools allow you to be more selective about which sections of the tape you require.

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- In general:  
It will be quicker to use a tapeless camcorder unless the need to edit the video clips offsets the time saved in importing them.
- For the most part, the encoding used by the device is unimportant because Dartfish will work with DV, MPEG-2 and MPEG-4 videos, including the HD equivalents HDV and AVCHD.

## STROMOTION & SIMULCAM

These two special effect tools are found in the ProSuite and TeamPro editions only and although their use is perhaps more specialised than other analysis tools, for the right situation, they are indispensable. The important thing to know about these tools is that they cannot use MPEG-4 video, i.e. only AVI, MPEG-2 and WMV formats are supported.



## YOU ARE HERE!

You should now be in a position to decide whether you need a tape camcorder or a tapeless camcorder based on the Dartfish tools that you will use.



Use this listing to discover which devices work with Dartfish's video import tools.

	Live import tools	Post-recording import tools
	InTheAction / Tag Live DV Import	DV Import / Import from DVD Import from Camcorder
miniDV Camcorder	✓	✓
HDV Camcorder	✓	✓
DVD Camcorder	✗	✓
HDD Camcorder	✗	✓
AVCHD Camcorder	✗	✓
USB / 1394 Webcam	✓	n/a
Digital video converter	✓	n/a
Video to DV converter	✓	n/a



## HD OR NOT HD? THAT IS THE QUESTION!

The answer to this question is primarily a question of image quality: because HD images are more pixels wide and tall than SD images: They don't need to be stretched to fit on a computer screen and the resolution is much finer. Better quality? Who wouldn't want that! Well, with better quality comes more data. SD video already requires a lot of computer processing power and a good graphics card. HD video is even less forgiving of underpowered computers.

The other consideration is aspect ratio: the ratio of width to height. A "widescreen" 16:9 aspect ratio is useful when the action takes place across a wider area, for example for tactical analysis. However, the 4:3 aspect ratio video takes up less width on the screen.

### *Always remember:*

- HD resolution is 4 times bigger than an SD video so this will require a very powerful computer and, in general, more storage space.
- AVCHD in particular needs additional power to decode.
- If you are planning to create 4:3 aspect ratio videos, then you will be forced to use SD video, since HD video is always recorded in 16:9 format.  
However, some SD cameras can switch to the 16:9 aspect ratio.
- Some HD cameras can still run in SD mode, but not all of them.
- Look for an HDV or AVCHD logo on a camera to determine what type of HD camera it is.

*Two of the main HD formats currently available to consumers on the market are HDV and AVCHD.*

### **MORE ABOUT HDV**

Just like DV format, the media used by HDV cameras are miniDV/DVC tapes.

Two major versions of HDV are HDV 720p and HDV 1080i. The former is used by JVC and is informally known as HDV1. The latter is preferred by Sony and Canon and is often referred to as HDV2.

This format is based on **MPEG-2** video compression, which is the same type of compression used for DVD video.

HDV camcorders have the advantage of offering video files of HD quality that aren't too heavy to process and, in common with other camcorders recording to miniDV tapes, also allow streaming to your computer via an IEEE 1394 output.

**HDV**  
HDV 1080i  
HDV 720p



## MORE ABOUT AVCHD

Advanced Video Coded High Definition (AVCHD) is a High Definition and Standard Definition recording format for use in digital tapeless camcorders, such as hard drive, 8 cm DVD discs and memory card based cameras.

AVCHD is recorded using the **MPEG-4 AVC/H.264** video compression codec.

One of the strong points of AVCHD over MiniDV tapes (HDV) is random access, since AVCHD uses a Hard Drive and thus does not need to be fast-forwarded or rewound, as on tape formats such as MiniDV (HDV).

AVCHD video files also have the advantage of being transferred to your computer at the maximum speed of the DVD, SDHC flash card, or hard drive via USB 2.0 connection. That means AVCHD files can realistically be transferred to the computer at speeds from 5 to 30 megabytes per second.

However, despite these advantages, AVCHD requires a lot more computer processing power compared to HDV format. A second disadvantage is that AVCHD cameras don't have a live streaming function.

***See Annex 1 for more information on the image size and specifications for HDV and AVCHD.***

## YOU ARE HERE!



So now you know which devices will allow you to work with the Dartfish tools you want to use and you can decide whether to use SD or HD video based on image quality balanced against computing power and storage required. This means that you can also decide whether you want a tape or tapeless camcorder. Finally you will be able to decide whether the 16:9 or 4:3 aspect ratio is most appropriate for you.

**AVCHD**



## OTHER CAMCORDER FEATURES TO CONSIDER

### SHUTTER SPEED

The best results for video analysis are rarely achieved in “point and shoot” mode. This is because the eye doesn’t detect motion blur when video plays at normal speed and so camcorders are optimized to give a bright image at the expense of a sharp one. As a video analyst, you will discover this as soon as you step through your video frame by frame. All but the simplest camcorders have an Auto Exposures (AE) set of programs and selecting the Sport AE, often shown as  or , is a good place to start. However, best results are obtained if you can manually select an appropriate shutter speed.

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- Ensure that you are able to manually adjust shutter speed (sometimes referred to as exposure).

### LOCATION OF FIREWIRE OUT

When using Dartfish’s live features you will want to have the camera on a tripod with a direct firewire connection to the computer. Some manufacturers haven’t considered this and have placed the firewire port behind the battery or on a separate docking station, which can’t be tripod mounted.

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- Don’t buy a camcorder with a separate docking station if you intend to use Dartfish’s Live tools.

### ZOOM

Zoom allows you to “frame” the action, allowing you to give the camera a coach’s eye view of what you want to observe. All camcorders have a zoom and generally, the amount of optical zoom they offer is more than adequate. However, the zoom control on some camcorders can be harsh, making it difficult to follow the action as it moves. This is only really important to you if you will be filming action moving towards or away from you.

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- Look for a camcorder with a smooth zooming action that gives you control over the speed of the zoom.



## CHIP SIZE, CCD OR CMOS

Digital camcorders create images by light falling onto a chip. In theory a larger chip size should result in a better image but miniaturisation is producing better and better results from smaller chips. Furthermore, there are two types of chip in use - CCD and CMOS. CMOS chips are comparatively smaller. When a camcorder boasts 3CCD, it has one chip for the red, green and blue lights, which allows for a better colour resolution.

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- For the best image quality, ignore the technical boasts and look for online or magazine reviews.
  - How well does the camcorder perform in the light conditions you will use? Many camcorders perform well when there is adequate light but images start to look grey and grainy in lower light conditions.
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## RECORDING TIME

How much recording time do you need? How long will you want to record for without changing the recording medium? To some extent this is dictated by the recording medium (60 minutes of recording onto DV tape) but tapeless camcorders have a variable amount of storage space. Some devices have a maximum recording time before they automatically stop recording.

## PRICE TAG

“Fit for purpose” is the all important phrase here. If you are spending in the “prosumer” and “pro” ranges, lens size and quality will improve but also many of the features discussed above will be easy to access using buttons on the outside of the camcorder rather than through menus. The actual value of these features depends on whether they get used.



## VIDEO DEVICES IN DETAIL

In this section we consider a selection of video devices and their pros and cons in use with Dartfish.

### MINIDV CAMCORDER

- **Camera-to-PC connection type**

FireWire (1394)

- **Media Type**

MiniDV tape

Holds 60 minutes of video. The main disadvantage to Dartfish users is that recordings can only be captured to computer in real time.

- **Video Encoding**

DV (AVI)

Historically, the development of Dartfish software began around the DV standard, mainly for picture quality reasons, but also because of the huge presence of DV Camcorders on the market. Files are less compressed and so larger than other formats, but of higher quality.

- **Dartfish Use**

Live import tools	Post-recording import tools
InTheAction / Tagging DV Import	DV Import / Import from DVD Import from Camcorder
✓	✓

- **More Information**

MiniDV camcorders remain among the most versatile devices for use with Dartfish.

They are found at all levels of quality and can be used for all Dartfish functions.



## HDV CAMCORDER

- **Camera-to-PC connection type**

FireWire (1394)

- **Media Type**

MiniDV tape

Holds 60 minutes of video. The main disadvantage to Dartfish users is that recordings can only be captured to computer in real time.

- **Video Encoding**

HDV

The HDV Camcorder is the High Definition standard to use with Dartfish software if you want to take advantage of Live features. The HDV type camera is the evolution of the DV type camera. It can now film in high definition and is still able to switch back to standard definition when necessary.

- **Dartfish Use**

Live import tools	Post-recording import tools
InTheAction / Tagging DV Import	DV Import / Import from DVD Import from Camcorder
✓	✓





## HARD-DISK (HDD) CAMCORDER AVCHD HARD-DISK & FLASH CAMCORDERS

- **Camera-to-PC connection type**

USB 2.0

Flash cards can also be removed from the camcorder and read directly via a card reader.

- **Media Type**

Integrated Hard-disk drive

Flash memory cards

Hard disk camcorders have the potential to hold more minutes of video than any other recording medium but once full, files must be removed to be able to continue recording.

Flash cards allow significant miniaturisation of the device and can be replaced when full.

- **Video Format**

MPEG-2, AVCHD (MPEG-4)

- **Dartfish Use**

Live import tools	Post-recording import tools
InTheAction / Tagging DV Import	DV Import / Import from DVD Import from Camcorder
✗	✓

These devices don't have any streaming or DV In/Out capabilities. Therefore they are unusable for any Live usage with Dartfish software. However, access to video for post-action analysis can be very fast.



## DVD CAMCORDER

- **Camera-to-PC connection type**

USB 2.0

DVD can be read directly by a computer's DVD player.

- **Media Type**

Single-sided MiniDVD-R or MiniDVD-RW.

This is the biggest limitation of these camcorders – MiniDVD holds just 1.2GB of data, just 30 minutes of video at the best quality these devices offer.

- **Video Encoding**

MPEG-2 (using the DVD specific .VOB file extension)

The main advantage of this recording medium is that the resulting disk can be played back on a DVD player.

- **Dartfish Use**

Live import tools	Post-recording import tools
InTheAction / Tagging DV Import	DV Import / Import from DVD Import from Camcorder
✗	✓

These devices don't have any streaming or DV In/Out capabilities. Therefore they are unusable for any Live usage with Dartfish software. However, access to video for post-action analysis is faster than from tape. Your computer's ability to read a DVD is slower than a flash card or hard drive so DVD camcorders are less efficient for post-recording analysis.

Dartfish's DVD import feature can be used to import and categorise video files held on DVDs.



## USB WEBCAM/1394 WEBCAM

- **Camera-to-PC connection type**

USB or Firewire (1394)

- **Media Type**

None. Webcams stream images directly to a computer.

- **Video Encoding**

None. Webcam video is uncompressed, therefore the data transmitted through USB or 1394 is very heavy. It means that a webcam will generally only be able to give out a framerate of about 15fps, with a picture size of 640x480.

The amount of Live Delay and Pre-record that can be used will be severely reduced.

- **Dartfish Use**

Live import tools	Post-recording import tools
InTheAction / Tagging DV Import	DV Import / Import from DVD Import from Camcorder
✓	✗

Users of InTheAction's Delayed Live view will find that many less seconds of video can be cached because video is uncompressed. On the other hand, it has a few advantages: it is auto-powered through the USB or 1394 port and is often found built into laptops. Therefore, it can be useful for a quick capture on the field. DV Import can be used to convert and compress live webcam video for post-recording analysis.

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- Overall, we cannot recommend the use of webcams with Dartfish. Nonetheless, they may be of value in particular situations.

- **More Information**

Basic settings such as picture size, brightness and frame rate can be adjusted using the webcam's software. These features can also be accessed through Dartfish software but vary according to the sophistication of the webcam. Zoom and focusing features will be basic or non-existent. Overall image quality is extremely poor and cannot be compared with DV, HDV or AVCHD camcorders.





## USING DEVICES WITHOUT DV OUT BY CONVERTING ANALOGUE OUTPUT TO DIGITAL

So what do you do if you have a device that isn't capable of streaming digital video to a computer but you want to capture live images? The answer often derives from the fact that many devices have an analogue output to stream images to a television. Here we examine two conversion devices that have been tested for use with Dartfish.

### DIGITAL VIDEO CONVERTER

- **Device**

Plextor ConvertX PX-AV200U

[www.plextor.com](http://www.plextor.com)

- **Connection to PC**



Analogue source to converter: S-Video or RCA (Cinch): 1x Video + 2x Audio

Converter to PC: USB 2.0

- **Video Encoding**

None.

Plextor's PX-AV200U is an analogue video to digital converter.

It lets you plug any analogue device in (VCR, analogue camcorder, TV, etc) and will then send a very heavy uncompressed video signal, similar to a webcam stream, to your computer.

It supports PAL, NTSC and SECAM analogue signals.

- **Use in Dartfish**

This device will allow you to use Dartfish's live features but keep in mind that since the streaming is uncompressed the data transmitted will be very heavy for your computer to process.

You can also import the signal, using the "DV Import" or "Tagging" module and then use generated clips in any other module. These tools can also encode the signal to DV, WMV or MPEG. However, InTheAction doesn't encode video.

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- This type of converter is especially useful for converting an analogue input where Dartfish is able to encode video. With InTheAction, the amount of live delay will be more limited and a lot of computer power will be required to process the input.



## VIDEO TO DV CONVERTER

- **Device**

Miglia Director's Cut

[www.miglia.com](http://www.miglia.com)

Canopus ADVC-55

[www.canopus.com](http://www.canopus.com)

- **Connection type**

Camera to converter: analogue (Input: 3x C-inch)

Converter to Camera: analogue (Output: 3x C-inch)\*

Converter to PC: FireWire (1394)

*\*Only on Director's Cut. ADVC-55 doesn't feature an Output.*

- **Video Encoding**

DV

These devices are hardware analogue-to-digital converters.

They let you plug any analogue device in (VCR, analogue camcorder, TV, etc) and convert its video signal to digital for computer use, using an on-the-fly DV compression.

It supports both NTSC and PAL analogue signals.

- **Use in Dartfish**

You can use Dartfish's Live features with this device. In fact you can import the signal in Dartfish Software, using the "DV Import", "InTheAction" or "Tagging" modules, and then use generated clips in any other module.





## VIDEO TO HDV CONVERTER

- **Device**

Canopus ADVC-HD50

[www.grassvalley.com](http://www.grassvalley.com)

- **Connection to PC**

Camera to converter: HDMI cable (HDCP not supported)

Converter to PC: FireWire cable (IEEE1394 6p converter side)



This converter is a hardware HDMI to HDV converter.

It lets you plug any HDMI input device in (HD TV, AVCHD camcorder, satellite, etc) and converts the HDMI video signal to an HDV signal.

It supports both NTSC and PAL signals.



Follow the manufacturer's instructions to power the device.

- **Supported video resolution input**

> 1920x1080 (59.94i, 50i), 1280x720 (59.94p, 50p)

> 720x480 (59.94p), 720x576 (50p), 640x480 (60p)

- **Supported audio format input**

LPCM 2ch at 16-24 bit, 32/44.1/48 kHz

- **Output video formats**

> HDV Type-1 (720p): 1280x720/59.94p, 1280x720/50p

> HDV Type-2 (1080i): 1440x1080/59.94i, 1440x1080/50i

- **Output audio format**

Stereo MPEG-1 Audio Layer 2 384 kb/s (multiplexed)

- **Use in Dartfish**

You can use Dartfish's Live features with this device. In fact, you can import the signal in the Dartfish Software, using "DV Import", "InTheAction" or "Tagging" modules, and then use these clips in any other module.



## WHERE YOU ARE NOW!

So now you should have a good idea of which camcorder will meet your specific needs when using Dartfish. You are aware of the pros and cons of different camera formats and you have a shopping list of features that you can check when choosing a camcorder.

Finally, if you already have a camcorder or other device that provides an analogue output, but not a digital one, you will have an idea of conversion devices that you can use.

Good luck with your camcorder choice!



## ANNEX 1: HDV AND AVCHD SPECIFICATIONS

HDV SPECIFICATIONS: VIDEO			
Format	HDV 720P	HDV 1080i	HDV 1080P
Scanning type	progressive	interlaced	progressive
Frame aspect ratio	16:9		
Frame size in pixels	1280*720	1440*1080	
Video signal	720/60p, 720/30p, 720/50p 720/25p, 720/24p	1080/60i, 1080/50i	1080/30p, 1080/25p, 1080/24p
Video Compression	MPEG-2 Video		
Bitstream rate	~20 Mbits/s (for audio and video)	~25 Mbits/s	
Audio			
Compression	MPEG-1 Audio Layer II		
Audio mode	Stereo (2 channels), optional 4-channel MPEG-1 Audio Layer II		
System			
Stream type	MPEG-2 transport stream (MPEG-2 TS)		
Stream interface	IEEE 1394 (FireWire 400)		
Media	Full-size DV or compact DVC cassette		

AVCHD SPECIFICATIONS: VIDEO			
Format	AVCHD 720P	AVCHD 1080i	AVCHD 1080P
Scanning type	progressive	interlaced	progressive
Frame aspect ratio	16:9		
Frame size in pixels	1280*720	1440*1080 / 1920*1080	
Video signal	720/60p, 720/50p, 720/24p	1080/60i, 1080/50i	1080/24p
Video Compression	MPEG-4 AVC/H.264		
Bitstream rate	Variable, up to 24 Mbits/s (for audio and video)	~25 Mbits/s	
Audio			
Compression	Dolby Digital (AC3)		
Audio mode	1 to 5.1 channels		
System			
Media	Hard-disk drive, flash memory card, 8 cm DVD		