

BCARES

Boulder County Amateur Radio Emergency Services

Amateur Television(ATV) Training



Boulder & Broomfield Counties ARES (R1 D3)



Boulder County RACES

non profit 501(c)(3)



Presenter:

Dave Sharpe – **KI0HG**

Served Agencies

- ◆ Boulder County Sheriff's Office
- ◆ Boulder City Police Department
- ◆ University of Colorado Police
- ◆ Longmont Police Department
- ◆ Broomfield Police Department
- ◆ Fire Departments – city & rural

Training Objectives:

- ◆ Answer Why Amateur Television (ATV) is an important technology we use in support our served agencies.
- ◆ Explain what Amateur Television (ATV) is.
- ◆ Address ATV Use and Privacy.
- ◆ Explain common ATV terminology.
- ◆ Show how the equipment comes together to provide a video link
- ◆ Demonstrate best known operating practices and procedures.
- ◆ Demonstrate how to set up and make operational the various types of ATV camera backpacks.
- ◆ Basic trouble shooting techniques (specific to ATV backpacks)
- ◆ A little bit of technical background (But not too much)
- ◆ Show how we support the CU Football Games.
- ◆ Show the various other ATV equipment we use (Quad Box, Portable Repeater, Monitors, etc.)
- ◆ Explain what is required for Field Support level certification.
- ◆ Provide an opportunity for certification.

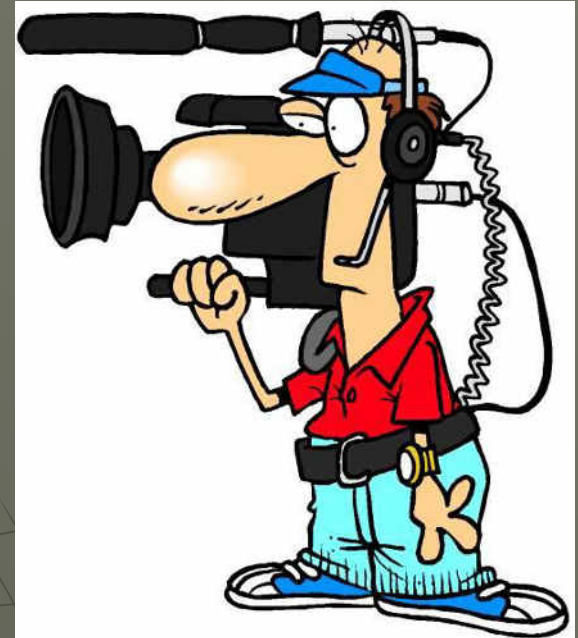
What is Amateur Television (ATV)

- ◆ **ATV** is the transmission of Video and Audio signals over any of the frequencies allocated to Amateurs.
- ◆ Various transmission standards are available, but here in the United States it's: **NTSC/RS-170**
- ◆ Any Cable ready Analog TV (**CATV**) may be used as a receiver. (CATV/Cable Channel 58-61 fall within the 70cm band)
- ◆ Bands suitable for ATV Propagation are **≥70cm**
- ◆ Propagation is **line-of-sight** (typical of UHF)
- ◆ This is Fast-Scan TV (FSTV) signal
(Not to be confused with Slow-Scan TV (SSTV) which can transmit via shortwave)
- ◆ No Amateur license class restrictions.

Deployments

BCARES has provided video for:

- ◆ 21 wild-land fires
- ◆ 1 Major Flood
- ◆ 22 Simulated Emergency Tests
- ◆ 85+ CU Football games
- ◆ 6 ARRL Field Days
- ◆ 9 BCARES only exercises
- ◆ 8 EOC sponsored Special Events
- ◆ 1 Search and Rescue



BCARES records 1994-2011

There are likely some not recorded

ATV Use & Privacy

- ◆ Certain privacy protections do apply but there is no expectation of privacy in a public place.
BCARES always operates in full view of the public.
- ◆ In compliance with FCC audio rules we generally do not transmit audio. *However!!*
Audio is still being recorded by the camera. The recorded media may be reviewed at a later time by our served agencies.
- ◆ Recorded Video may provide documentation to be used by any party.
- ◆ BCARES ATV policy is typically reviewed on an annual basis.

Identifying The Transmission

The same rules that apply to regular FM Voice transmissions, also apply to ATV. But there are several ways this may be accomplished:

- ◆ CW-Tone/Voice on the audio carrier. (FM Signal)
- ◆ Visually on screen – Such as a title or placard
- ◆ **BCARES** uses a separate simplex frequency for video coordination and typically will use Tactical designators for each Camera and/or Location.

Identifying/Logging The Event

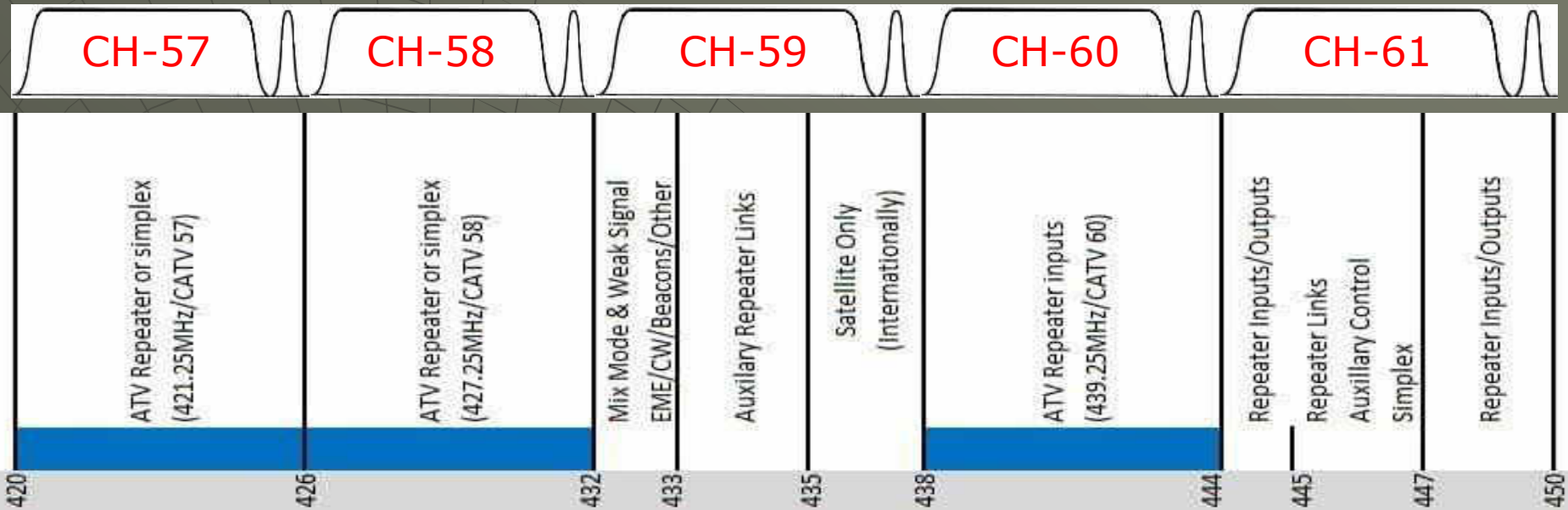
- Net Control** keeps a log of all events and incidents:
- ◆ Information about video entries are noted.
 - ◆ Older 8mm Tape Cameras with "time on tape"
 - ◆ Newer Digital Cameras by cycling the record.
 - ◆ To help in after action reports and training; Some agencies like us to provide tapes along with logs
 - ◆ It is not uncommon for an incident or event to be documented on multiple cameras and tapes.

ATV Band Plans

Amateur Radio Television (ATV) Band Plans

Band	Video Carrier	
70cm 430-450MHz	421.250MHz	Cable Channel 57
	427.250MHz	Cable Channel 58
	433.250MHz	Cable Channel 59 (Not Recommended)
	439.250MHz	Cable Channel 60
	445.250MHz	Cable Channel 61 (Not Recommended)
33cm 902-928MHz	909-915MHz	(910.25MHz)
	921-927MHz	
23cm 1240-1300MHz	1240-1246MHz	ATV #1
	1252-1258MHz	ATV #2
	1260-1270MHz	
	1276-1282MHz	ATV #3
	1288-1294MHz	
13cm 2390-2450MHz	2390-2396MHz	
	2418-2430MHz	
	2438-2450MHz	

70cm Band (420-450MHz)



Each ATV Channel has a 6MHz Bandwidth.

- ◆ CH-59 & CH-61 are NOT recommended due to their likely interference to Repeaters and other active frequencies.
- ◆ Vestigial Sideband (VSB) is recommended for ATV

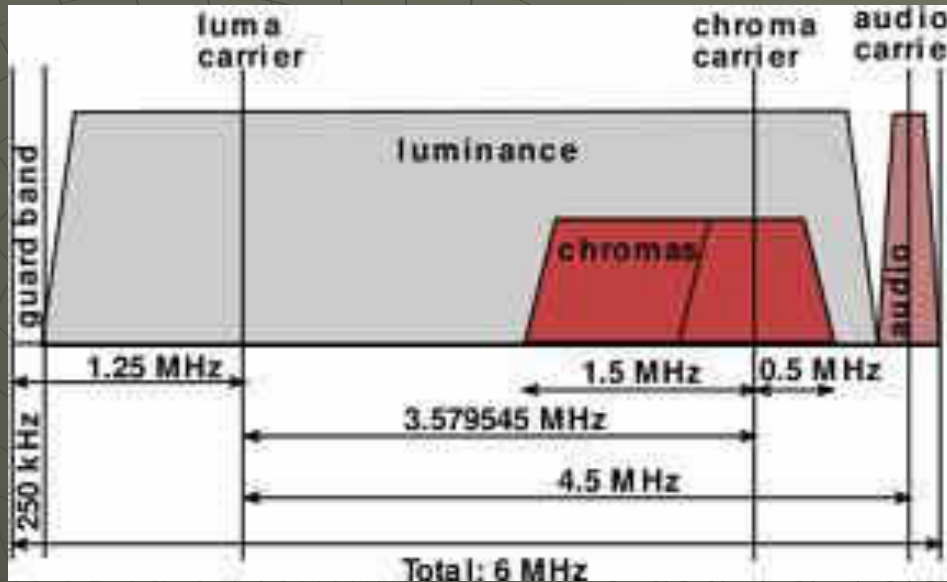
Vestigial Sideband (VSB)

- ◆ Video information typically contains frequencies as high as 4.2 MHz. A fully amplitude modulated television signal would then occupy $2(4.2) = 8.4$ MHz.
- ◆ This is an excessive amount of bandwidth and is wasteful of spectrum space, because not all of it is required to reliably transmit a TV signal.
- ◆ To reduce the bandwidth to the **6 MHz maximum allowed by the FCC** for TV signals, a portion of the lower sideband of the TV signal is suppressed leaving only a small vestige of the lower sideband.
- ◆ Such an arrangement is known as a **vestigial sideband signal**.
- ◆ Video signals above 0.75 MHz (750 kHz) are suppressed in the low sideband, and all video frequencies are transmitted in the upper sideband.

*Spectrum International
7 Pole PSF ATV VSB Filter*



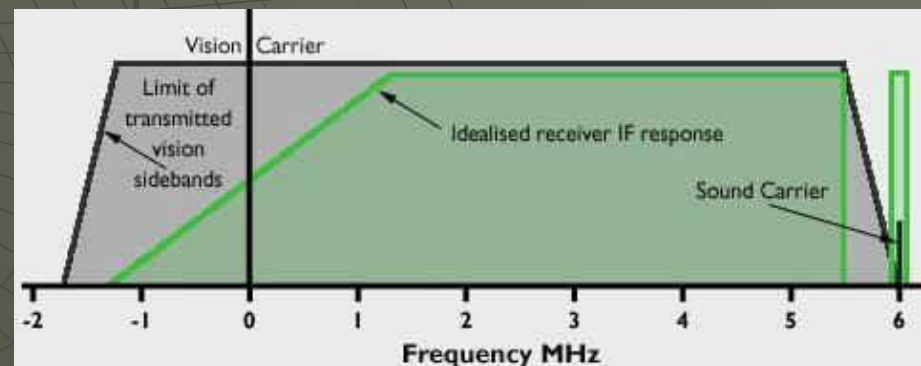
What's in a Channel?



Video Signal is AM

Audio Signal is FM

Effect of Vestigial Sideband Filtering

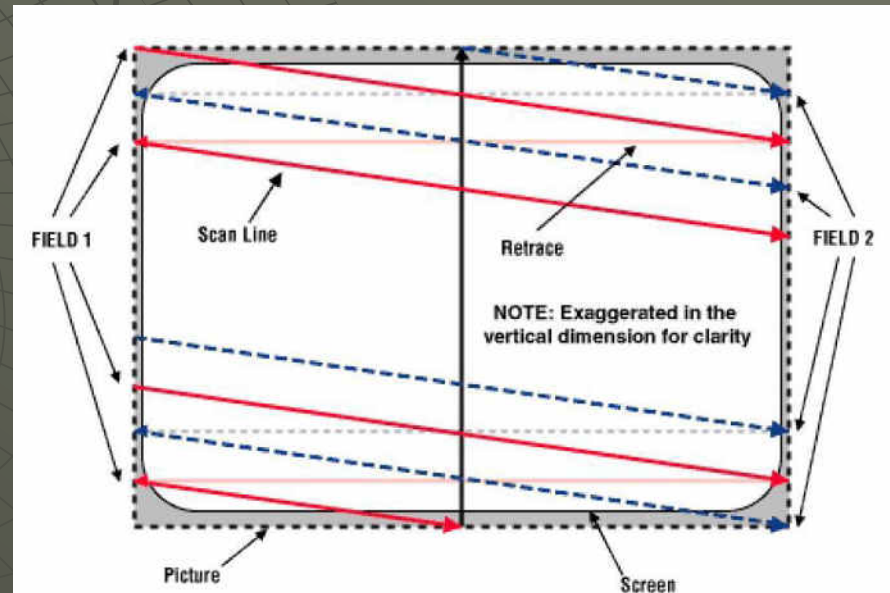


Composite Video (NTSC RS-170)

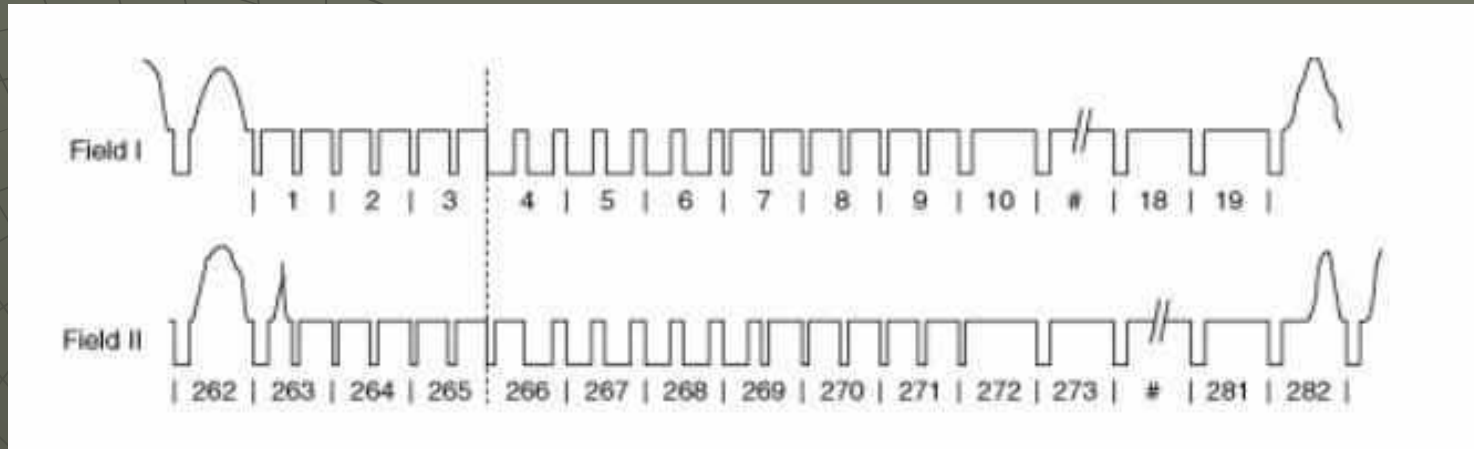
- ◆ In 1953 the National Television System Committee (NTSC) approved the Color Television Standard we know today as RS-170A
- ◆ In 2009 the FCC mandated that all Commercial analog Television broadcasts would cease and be replaced by Digital Television DTV broadcasts. (We still use analog)

Each Analog television signal consists of:

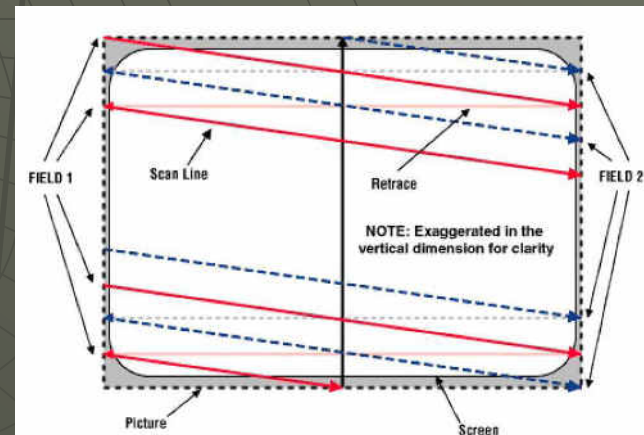
- ◆ 29.97 Interlaced frames of video per second.
- ◆ 525 Lines per frame.
- ◆ 262.5 lines per field
Odd/Even
- ◆ 640x480 (WxH) Pixels



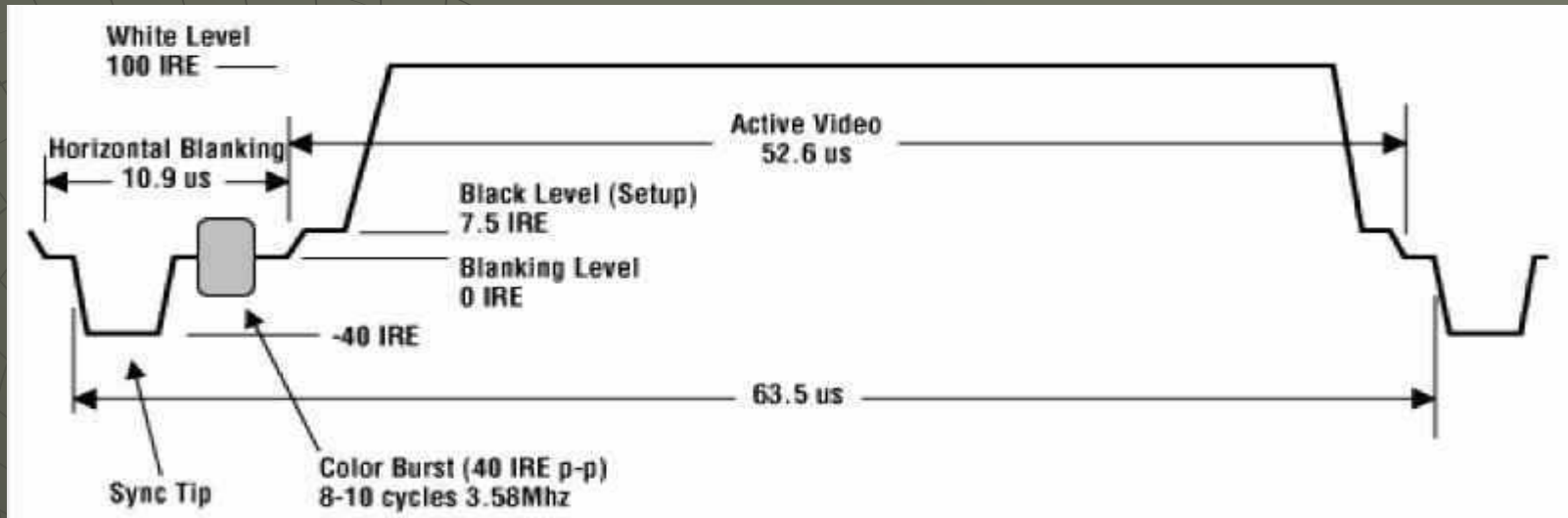
Composite Video (NTSC RS-170)



- ◆ Vertical Synchronization or Serrations signal the beginning or top of each field. (Odd & Even / Each is slightly different)
- ◆ Known as the Vertical Blanking Interval.
- ◆ 20 Horizontal Lines in length
- ◆ Odd field starts Top Left
- ◆ Even starts Top Middle



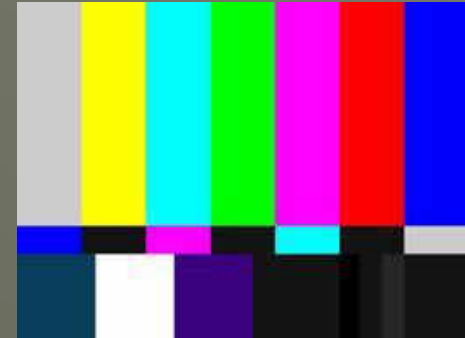
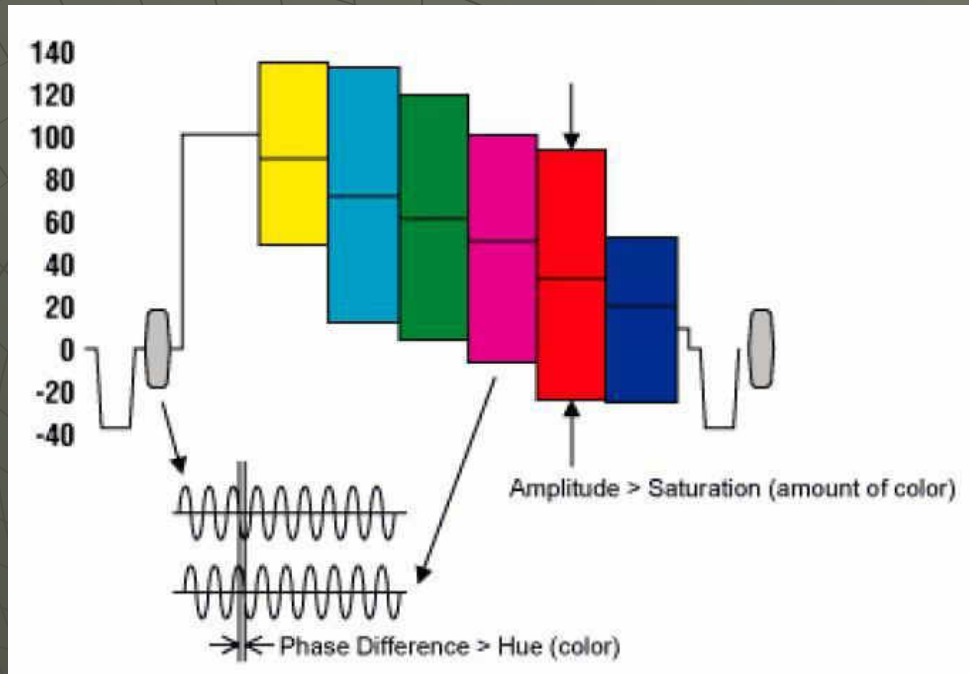
Composite Video (NTSC RS-170)



Each Horizontal "Line" consists of:

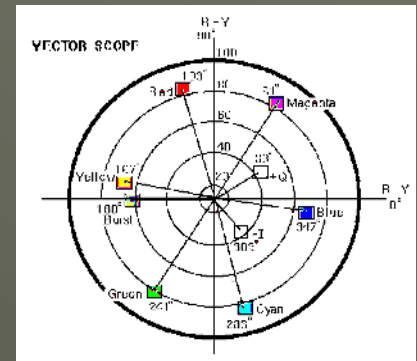
- ◆ Standard NTSC Video Level is 1Vp-p or 140 IRE.
- ◆ Horizontal "Sync Tip" signals the beginning of each new line. (-40 IRE or about -300mV)
- ◆ Full Video Frame is 525 of these Lines in Two fields.

Composite Video (NTSC RS-170)



Color is the result of Phase, not Amplitude:

- ◆ Color Burst (3.58MHz) is each lines reference.
- ◆ Phase difference determines the Hue (Color)
- ◆ Contrast is the product of the magnitude.



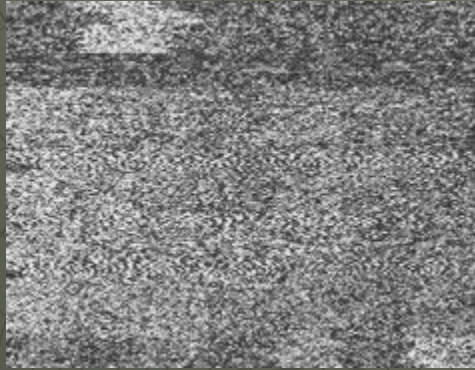
Picture Quality

Knowing how to communicate the picture quality is vital!

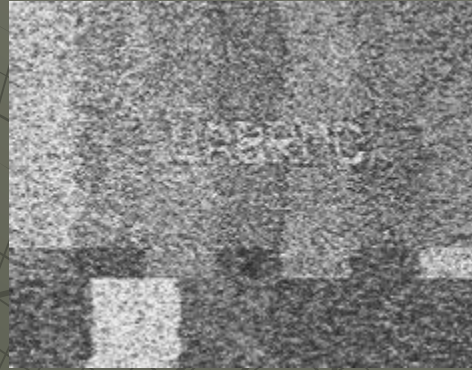
- ◆ "P" Stands for Picture Level and ranges from 0 to 5.
Example: "Your signal is P5 plus" or Broadcast Quality.
- ◆ Like any signal reporting system, the report is based on experience. Thus there is some subjectivity that goes along with the signal to noise ratio.
- ◆ P5 (SNR > 45dB) No discernible noise. "Broadcast Quality"
- ◆ P4 (35-45dB) Slight/Minimal Noise. "Typical Quality"
- ◆ P3 (20-35dB) Somewhat Noisy. "Useable"
- ◆ P2 (8-20dB) Definitely Noisy. "Barely Usable"
- ◆ P1 (3-8dB) Barely see Text ID, Image shadows.
- ◆ P0 (< 3dB) Is there really a signal there? "No Picture"

But what do they look like?

Picture Quality P0-P5



P0



P1



P2



P3



P4



P5

When Operating a Camera

Common Video Terminology:

- ◆ Panning – Left/Right Movement of the camera. “Pan Left”
- ◆ Tilt – Up/Down movement of the camera.
- ◆ Zooming – Level of video picture magnification.
 - “Zoom In” = Magnify the picture/More clarity
 - “Zoom Out” = More stuff in picture/Less clarity
- ◆ Tight or Wide – Applies to the level of zoom or amount of information in the cameras field of view.

“Get a tight shot of the face, then zoom back out where you have it now”
- ◆ Night Shot – This is a mode on most of our BCARES cameras that puts the camera in a mode more sensitive at lower light levels. It also picks out Forest Fire hot spots at dusk really well!!

When Operating a Camera

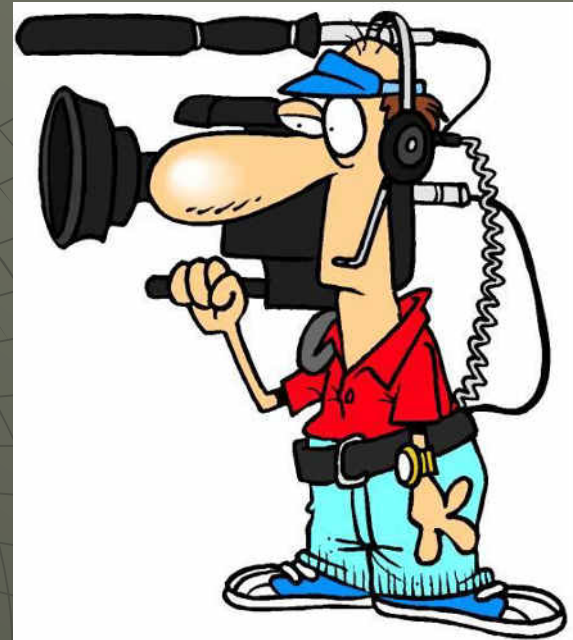
While Operating, Please, Please, Please:

- ◆ Zoom OUT before moving the camera or panning.
- ◆ When Panning do so in a slow and smooth motion.
- ◆ We Deploy Teams, #2+ has responsibility to keep both safe



- ◆ These operating practices greatly reduce viewer motion sickness and demonstrate the professional attitude of BCARES.

- ◆ But Wait...
There's More !!
- ◆ Time for a Break
- ◆ Be Back in 10min



CU Boulder Football Games

- ◆ One of our most significant training activities are CU Football Games.
- ◆ BCARES provides a great service to CUPD, BCSO, BPD, and Others helping ensure the safety of all who attend.
- ◆ A large portion of our technical and operational competency with ATV is directly related to our efforts at CU.



CU Boulder Football Games

- ◆ The “Tower” is the primary receive point and Stadium Base
- ◆ Located on the 11th floor of the Duane Physics building.
- ◆ Served Agency displays are located in the corner for the chief and at mid room.
- ◆ A 23cm Link transmits to the Press Box
- ◆ 70cm Receive antenna has good view of both main gate areas of Folsom Field.



CU Boulder Football Games

- ◆ “Press Box” is the location of CUPD’s Chief, Security, and control of fixed camera points around the stadium.
- ◆ Located on the 5th floor of the Field House.
- ◆ Display is located on the North wall for the chief and tie-in to Digital Video Recorders (DVR).
- ◆ The 23cm Link from the tower feeds Press Box
- ◆ An additional 70cm Receive antenna has a moderate view of both gate areas of Folsom Field for direct receive.



CU Boulder Football Games

- ◆ Student Gate or “Gate 6” is where most of the action is.
- ◆ Located near by is Franklin Field. (Tail-Gate Area)
- ◆ Typical Operating point for TV-57 and TV-60



CU Boulder Football Games

- ◆ Buffalo Plaza or “Gate 1” is the main outside concession area and access to Field House.
- ◆ Located across Colorado from Duane Physics Tower and the loading dock.
- ◆ Typical Operating point for TV-58



CU Boulder Football Games

- ◆ Advance Team consists of the more technical folks who arrive ahead of time for equipment load-in and setup.
- ◆ Participants park at the parking structure by CUPD and must clearly display a BCARES/CU parking pass.
- ◆ We gather at the loading dock at the base of Duane Physics, where Game color wristbands are issued.
- ◆ Still need your BCARES ID and Hat, Shirt, or other BCARES dress.
- ◆ With enough people we make every effort to move people around to the different operating positions. Even catch some of the game



Certification Requirements

BCARES Facility Support Level ATV Certification:

- ◆ Ability to select appropriate apparatus from equipment cache. (ATV Pack, Antenna, Poles, Tripods, Batteries, etc...)
- ◆ Demonstrate the ability to setup an ATV backpack and provide a video signal to the NCS.
- ◆ Show proficiency in camera operation.
- ◆ Qualify annually by participating in an exercise, event, or training and show 'ATV Proficiency' to a BCARES Board Certified Trainer.

- ◆ Knowledge and ability to operate the ATV Quad Box or Repeater are not required at this level of certification.
- ◆ Remember BCARES members have the ability to check out equipment. Just coordinate with our Quartermaster.



EQUIPMENT

ATV Backpack

- ◆ Video Camera
 - 8mm/HDD/SD Memory type
 - Night or low light capability
 - On-Screen titling (For ID & Time)
 - Ability to power from +12V Battery
- ◆ ATV Transmitter
 - Frequency Agile preferred
 - Ability to adjust transmit power is nice.
- ◆ Antenna
- ◆ Vestigial Sideband Filter
- ◆ 12V Battery (7 amp-hour)
- ◆ Power-pole distribution block
- ◆ Tripod

The backpack also contains:

- ◆ Plastic bag for rain mitigation
- ◆ Quick Reference/Camera ID Card



ATV Accessory Bag

Accessories:

- ◆ Extra power supply
- ◆ Power splitter and extra cable
- ◆ Video/Audio extension cable
- ◆ Small video monitor
- ◆ Extra battery
- ◆ Extra recording media.
- ◆ Antenna

Other accessories:

- ◆ 2x/3x telephoto converter
- ◆ Extra batteries for Remote's

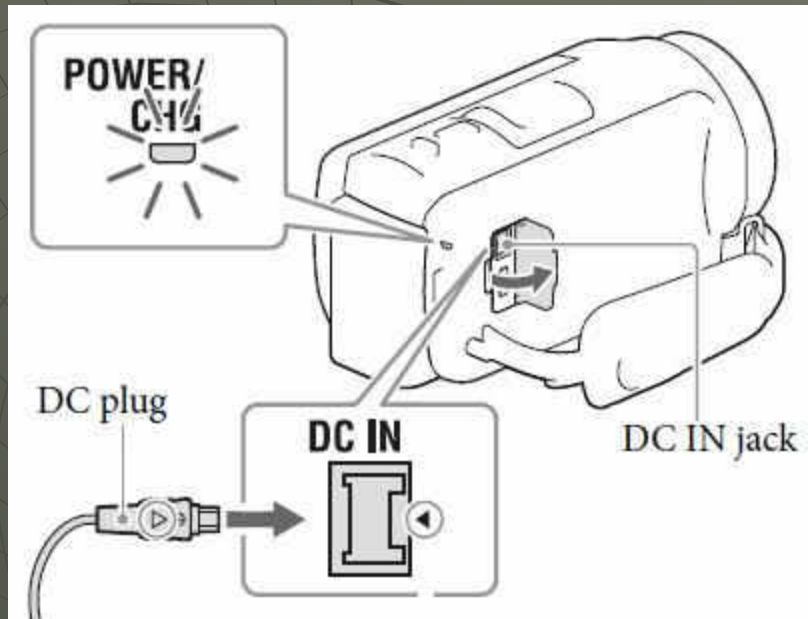


Camera (HDR-CX430V)

- ◆ Sony HDR-CX430V HD/SD
 - 16/32/64GB UHS-I SDHC & Sony PRO-Duo Memory cards
 - Internal 160GB HDD
 - Steady-Shot helps compensate for camera shake.
 - LCD Touch Screen (Be Careful when using/cleaning)
 - GPS Receiver (Can record meta-location data with video location)
 - No Night-Shot & Battery is NOT compatible with the XR200
- ◆ Record Times:

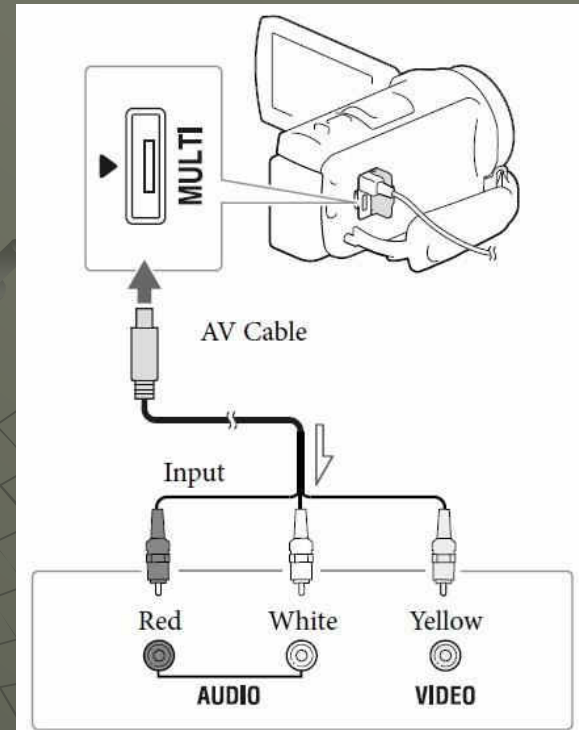
	High Definition "HD"				Standard Definition "SD"			
	Disk:	16GB:	32GB:	64GB:	Disk:	16GB:	32GB:	64GB:
FX:	2h40m	85m	180m	360m				
FH:	3h40m	120m	245m	490m				
HQ:	6h30m	210m	430m	865m	HQ:	9h55m	220m	445m
LP:	11h15m	370m	740m	1490m				

HDR-CX430V Connections



Power Connection

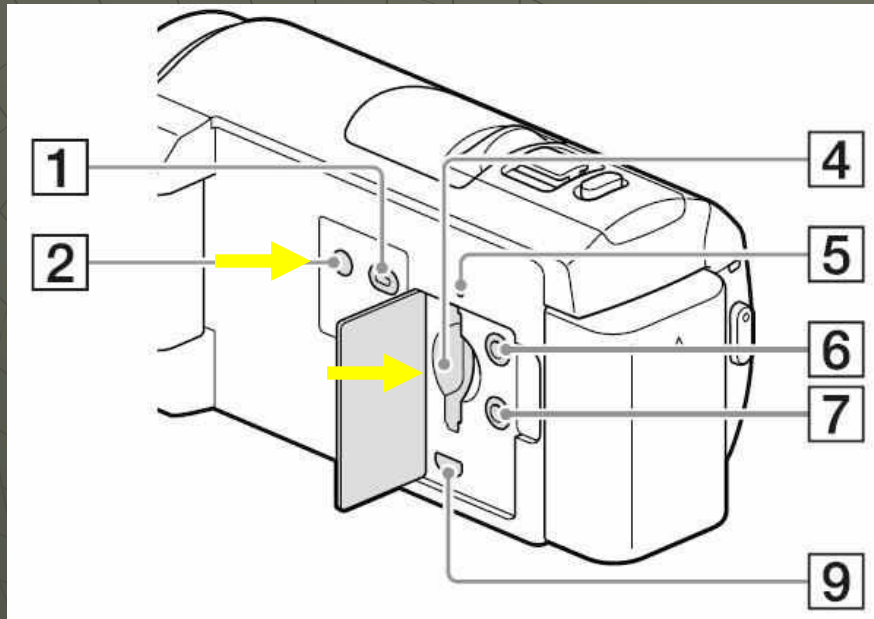
- ◆ Battery slides up and locks into position
- ◆ Battery Release is on Bottom of camera



Video Connection

- ◆ Normally Audio is not connected
- ◆ May not be RED due to extension cable

HDR-CX430 (Buttons)



- 1 (View Images) button
- 2 POWER button
- 4 Memory card slot
- 5 Memory card access lamp
While the lamp is lit or flashing, the camcorder is reading or writing data.
- 6 (microphone) jack
- 7 (headphones) jack
- 9 HDMI OUT jack



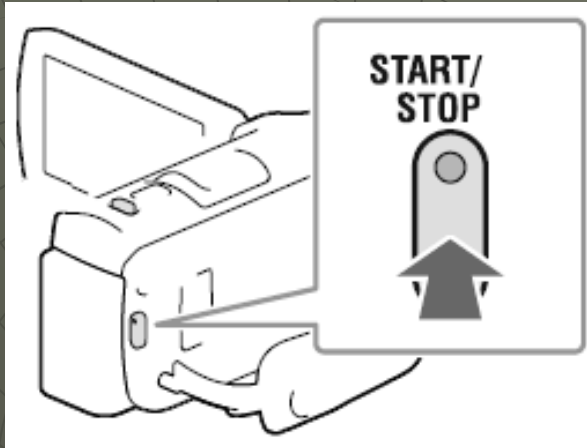
PRO Duo



Standard
SD Card

The CX430V is packed with features, but not many buttons. Our normal camera configuration disables LCD/Screen Auto Power-On/Off. The LCD/Touch-Screen and Menu is the main interface for setting up the camera. This allows the LCD/Screen to be closed with the camera remaining operational. The POWER button is used to turn the camera on and off. The Auto Power-On/Off feature. Even with so few buttons, operators need only a basic understanding to get the job done. PRO-Duo Memory cards are unique to Sony and are the same cards used with the XR-200V cameras. Cards are typically marked with "BC-#" for identification. An event or incident may require use of multiple cards. !!Please don't lose them!! We use memory cards rather than the Disk. (Download from Disk can take a LONG time)

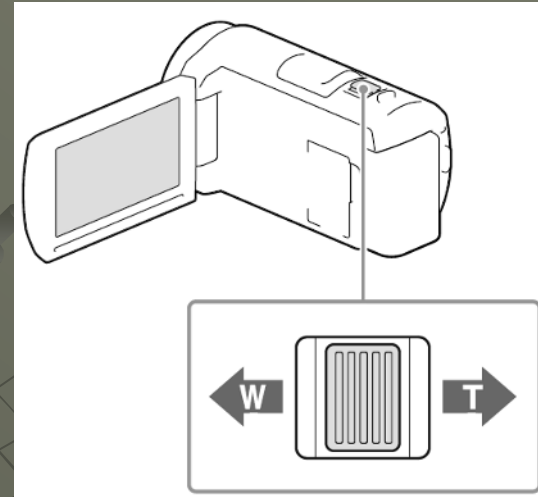
HDR-CX430 (cont)



Every time you cycle RECORD a new video file is created on the Memory/Disk.

If there is anything of interest, cycle REC to "tag" the event/incident.

Record/Standby Indicator on LCD



ZOOM Controls are located on both the top of the camera and also the LCD screen

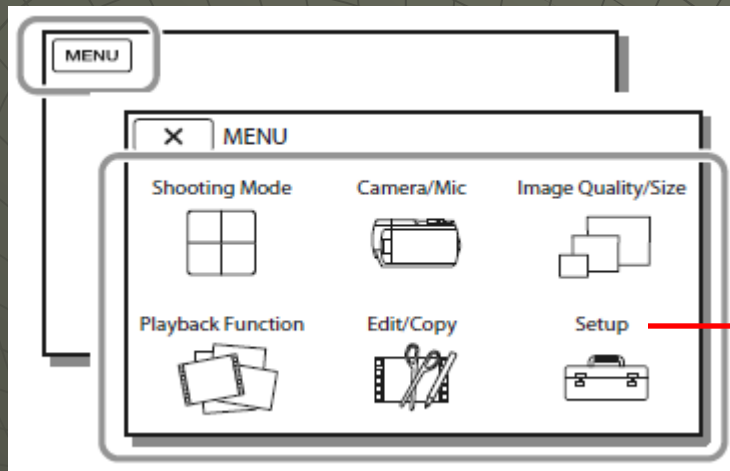
"W" is Wide / Zoom Out

"T" is Tight / Zoom In

Remember SLOW movements and Zoom Out BEFORE you PAN or move the camera.

HDR-CX430 (Menu)

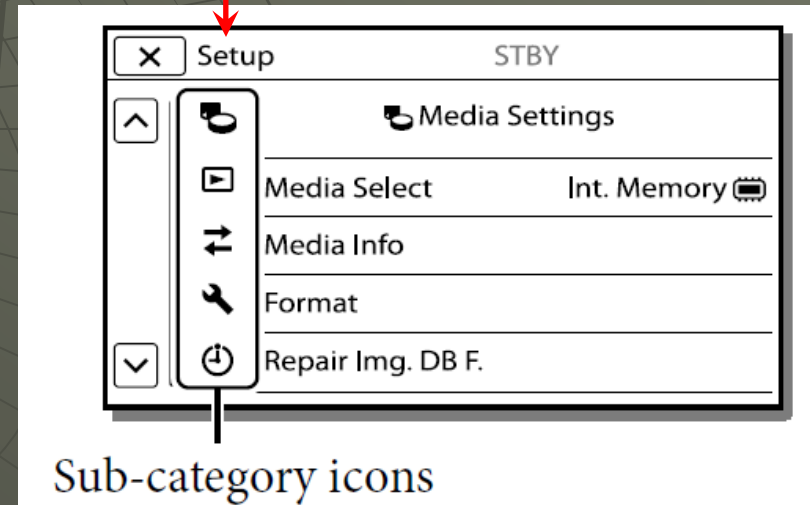
CX430V Menu Controls are somewhat different than the previous XR200. Unfortunately it's not all that uncommon to perform camera setup each deployment. The Li-Ion batteries are removed when stored and the setup memory time is limited. We try to keep a cheat sheet/card for setup options and which menu option gets you there



After pressing "MENU" in the top left corner of the LCD/Screen Six Menu Categories are displayed.

Each category brings up sets of sub-categories with an option list that scrolls up and down.

- You may have to scroll up or down depending on the last option set or list item viewed.
- Scrolling is achieved by use of the Up/Down arrows to highlight each item
- Skipping to a specific Sub-Category is done by touching the specific sub-category icon.



Sub-category icons

Camera (HDR-XR200)

- ◆ Sony HDR-XR200 HD/SD
 - 16GB Sony PRO-Duo Memory card
 - Internal 150GB HDD
 - Steady-Shot helps compensate for camera shake.
 - LCD Touch Screen (Be Careful when using/cleaning)
 - GPS Receiver (Can record meta-location data with video location)
- ◆ Record Times:

High Definition "HD"

Disk:

FH: 14h46m

HQ: 29h33m

SP: 37h12m

LP: 50h14m

Card:

1h58m

3h56m

4h57m

6h42m

Standard Definition "SD"

Disk:

HQ: 30h26m

SP: 43h41m

LP: 91h20m

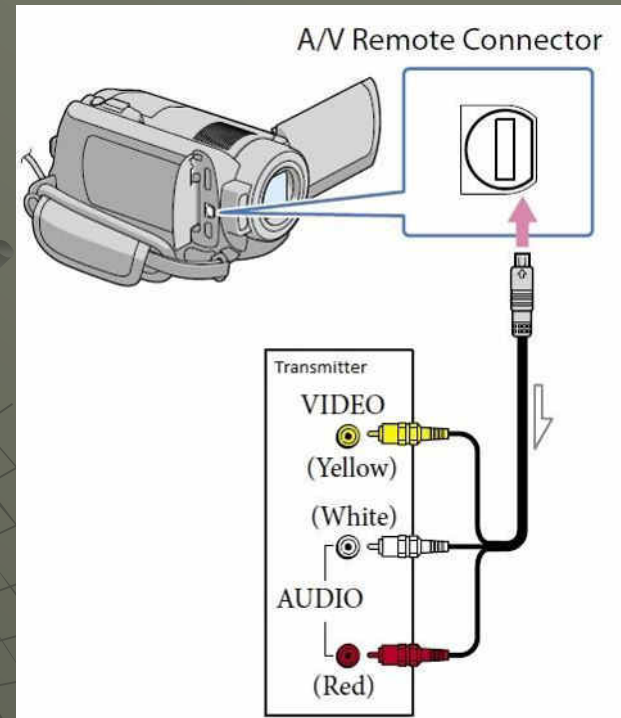
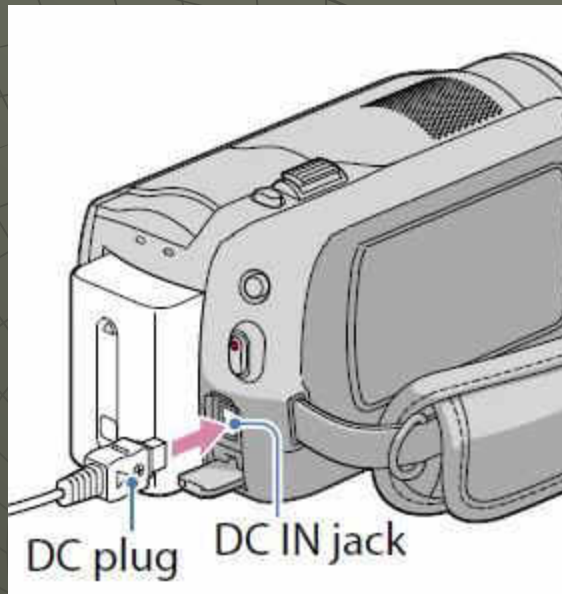
Card:

4h3m

5h50m

12h11m

HDR-XR200 Connections



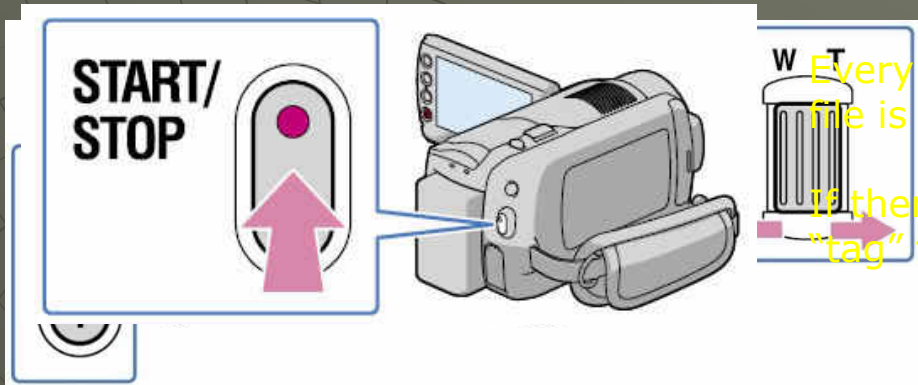
Power Connection

- ◆ Battery slides up and locks into position
- ◆ Battery Release is on Bottom of camera

Video Connection

- ◆ Normally Audio is not connected
- ◆ May not be RED due to extension cable

HDR-XR200 (back)



Every time you cycle RECORD a new video file is created on the Memory/Disk.

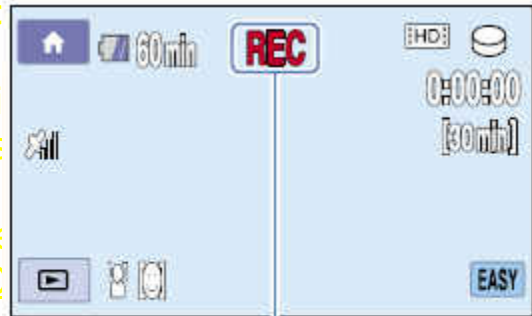
If there is anything of interest, cycle REC to "tag" the event/incident.



ZOOM Controls are located on both the top of the camcorder.

"W" is
"T" is

Remote
BEFC



Zoom Out
Camera.

[STBY] → [REC]

Record/Standby Indicator on LCD

1 [Movie] (Movie) / [Photo] (Photo) lamps

2 [CHG] (CHG) lamp

3 ACCESS lamp (Hard disk)

While the lamp is lit or flashing, the camcorder is reading or writing data.

4 Battery pack

5 DC IN jack

6 Power zoom lever

7 PHOTO button

8 MODE button

9 START/STOP button

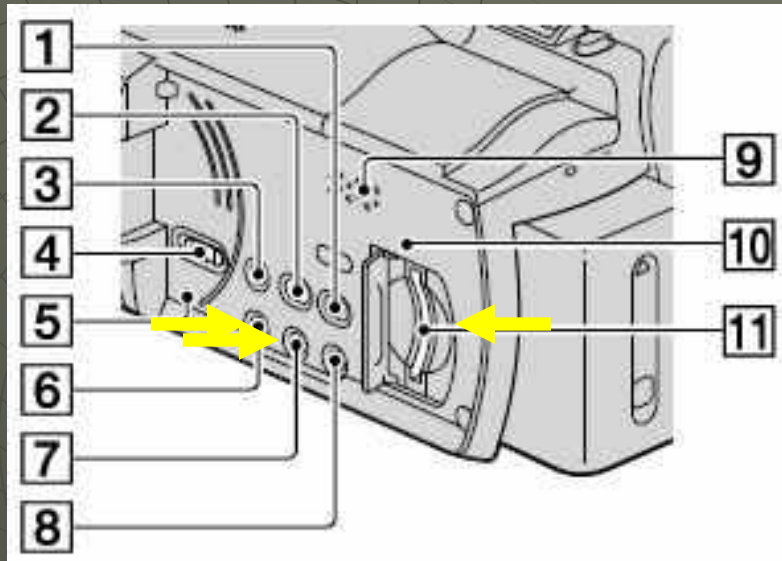
10 Grip belt

11 Hook for a shoulder belt

12 Tripod receptacle

13 BATT (battery) release lever

HDR200 (Buttons)



- 1 [▶] (VIEW IMAGES) button
- 2 [⊖] (DISC BURN) button
- 3 EASY button
- 4 GPS switch
- 5 RESET button
- 6 POWER button
- 7 NIGHTSHOT button
- 8 DISP (display) button
- 9 Speaker
- 10 Access lamp ("Memory Stick")
While the lamp is lit or flashing, the camcorder is reading or writing data.
- 11 "Memory Stick Duo" media slot

While these camcorders have many Buttons and Features
 NightShot uses infrared light and puts the camera
 in a normal view. Normally you can't see the LCD/Screen. Auto Power On/Off
 Operates on a battery pack. Recharge the battery for a few
 hours. The camera is in the Rear. Below the lens is used.
 The camera is in the Rear. Below the lens is used.



PRO Duo
16GB



Standard
SD Card

PRO-Duo 16GB Memory Sticks are unique to Sony. (An Adapter makes it SD Readable)
 Cards are typically marked with "BC-#" for identification.
 An event or incident may require use of multiple cards. !!Please don't loose them!!
 Unfortunately standard SD memory cards are not compatible
 We use memory cards rather than the Disk. (Download from Disk can take a LONG time)

Monitors



- ◆ Haier HLT-71 7" LCD Monitor
- ◆ Composite, HDTV, CATV, 12V

ATV Transmitter

Most of our newer ATV packs include the newer transmitters.

- ◆ UHF/70cm
- ◆ The frequency can be changed using 4 dip switches.
- ◆ Capable of up to 5Watts



Videolynx VM-70X
P.C. Electronics www.hamtv.com

Older ATV Transmitter

This is one of our earlier/older “Home Brew” Transmitters

- ◆ UHF/70cm Amplitude Modulated
- ◆ PC Electronics transmitter Kit
- ◆ Two Fixed ATV frequencies



Vestigial Sideband (VSB) Filter



A VSB filter reduces the AM lower sideband by $\sim 80\%$
This significantly helps with adjacent channel interference
(It also provides a handy heat sink for the transmitter)

ATV Quad Receivers

There are several different flavors within BCARES.

- ◆ Typically referred to as “The Quad Box”
- ◆ Made up of multiple receivers. (PicoMacom MPCD CATV Receiver modules)
- ◆ A Quad Video Processor gives ability to show Four video signals on a single screen.
- ◆ Typically multiple/extra VSB filters. (One for each receive channel)
- ◆ Video Distribution Amplifier or “DA”.
- ◆ 2 meter Radio for Coordination. (Typically 144.370MHz)

- ◆ In addition to the “Quad Box” are extra video monitors, Antenna’s, and possibly transmitter/s for repeater operation.

- ◆ Additional training covering Quad Box operation is available in a separate training coarse.

Quad Display



Picture provided to Broomfield ICV during the 2008 Republican State Convention

CU Quad Receiver

Housed in CU equipment cache, primary use is CU Football



ATV Repeaters

BCARES uses both a fixed and mobile ATV repeaters.

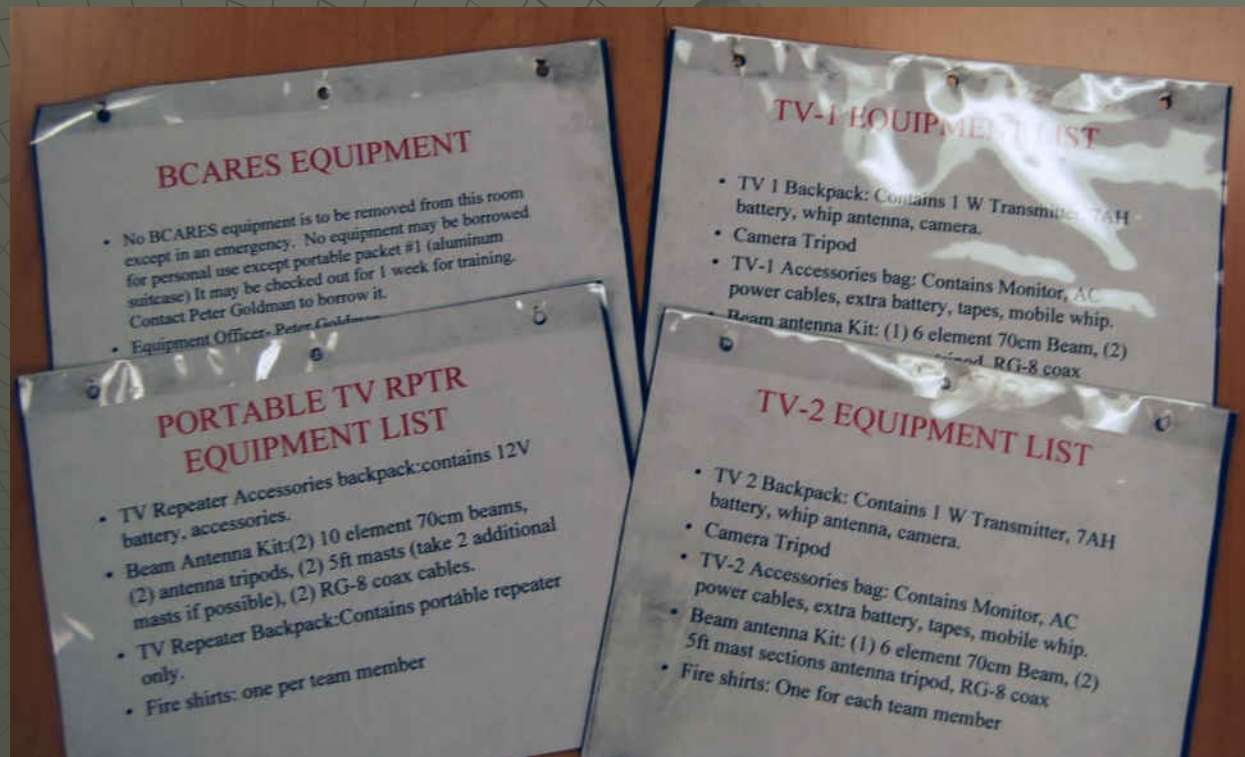
- ◆ Permanent Repeater is located on Chautauqua Park – W0BCR
 - Input: TV-60 (439.250MHz, AM)
 - Output: TV-57 (421.250MHz, AM)
 - Secondary Input on 23cm (1277.250MHz, FM)
 - Repeater is controlled via remote radio link.
- ◆ Portable Repeater (Field Deployable)
 - Input: TV-60 (439.250MHz, AM)
 - Output: TV-57 (421.250MHz, AM)
 - Modes: Transmit Only, Receive Only, or Repeater operation.
- ◆ Several BCARES members have personal Equipment that is also capable of ATV Repeater operation, and in some cases multiple “hop’s” may be required to get video to the destination.
- ◆ ATV Repeater operation is covered in a separate training coarse.

Resources

We attempt to keep instructions, training material, and other information current and standardize our video equipment.

- ◆ The “Red Book” describes set-up and use of all cache equipment.
- ◆ Instructions are also located in all go-bags and backpacks that hold the equipment.
- ◆ The “Red Book” and other information is available on our web site and training CD given to each member.
www.BoulderCountyARES.org/Reference.html

In the equipment cache there are lists of everything needed for deployment so you don't find yourself in the field with a missing component.



Thank You!!

This presentation is the result of significant and generous contributions of time, talent, material, and experience.

The presenters wish to thank:

David Sharpe (KI0HG)

Mark Huff (K0LRS)

Dale Scott (KA0QPV)

George Weber (KA0BSA)

Ueli Hauser (KB9TTI)

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