

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

Section	Page
1.0 Introduction.....	2
2.0 General Technical Requirements.....	2
3.0 High Definition Requirements.....	2
4.0 Program Content.....	3
5.0 Video.....	3
6.0 Editing.....	4
7.0 Title and Action Safe Area Information.....	4
8.0 Non-High Definition Footage Limitations.....	5
9.0 Film Acquisition and other formats.....	5
10.0 Visual Effects and Footage Treatments.....	5
11.0 High Definition Audio Requirements.....	6
11.1 Audio Channel Assignment Chart for HD Video tape.....	6
11.2 Audio/Video Sync.....	6
11.3 Noise Reduction and Digital Recordings.....	6
11.4 Dolby E.....	7
11.5 Dolby E Settings.....	7
11.6 DA-88 Digital Audio Master.....	8
12.0 Time Code.....	8
13.0 Graphics Master and Log.....	9
14.0 Video Deliverables Specifications for CGI Selects.....	10
15.0 References.....	11
16.0 1080p Technical Specification.....	12
17.0 720p Technical Specifications.....	13

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

1.0 Introduction

This exhibit contains all technical specifications for 720 PROGRESSIVE, 1080 INTERLACED and 1080 PROGRESSIVE HD tape formats.

All programmed material acquired for National Geographic Channel must be of a high technical standard originated and post produced on equipment that meets US broadcast performance specifications and must fully comply with SMPTE Standard codes of practice.

It is important that control rooms and viewing rooms used to assess program quality during post-production do not affect subjective impressions of the luminance, resolution and color attributes of the picture. CCIR Recommendation 500 gives details of suitable viewing angles, distances luminance levels and background lighting etc.

2.0 General Technical Requirements

Master and source videotapes must meet industry standard or industry-accepted standards for tape format interchange. Acceptable mastering formats must be on either Sony SR or Panasonic D5 High Definition video tape.

Final Program Edit Decision List: An AVID EDL of final program edited master.

3.0 High Definition Requirements:

- 1) National Geographic Channel (NGC) requires a High Definition 1080i at 59.94 fps (preferred) or 720p at 59.94fps version of the program master material. It should be delivered on either a Sony HDCAM SR or Panasonic D-5 video tape in 1080i at 59.94 fps (preferred) or 720p at 59.94fps. Letterboxed 4x3 material will not be acceptable.
- 2) Original shooting format (source tapes): this production shall be photographed in 16:9 with a 14:9 safe action area in HD.
- 3) Video and Audio program material shall be produced using industry standard and accepted norms of good practice and workmanship. All content must be shot and edited in the native delivery format.
- 4) NGC supports the production of television programming in the 720p – 59.94fps, 25 & 50, 1080i – 59.94fps 25 & 50 and 1080p – 24fps formats. **All Vendor Masters must be frame rate converted to 59.94fps and delivered at 59.94fps. NGC will not accept Vendor Master delivered in any other frame rate other than 59.94fps. Masters must be converted on acceptable broadcast quality conversion system. Conversion masters will be subjected to NGC’s quality control process and will be rejected if found to contain conversion artifacts or to be of poor quality. NGC does not support productions that are shot on HDV tape formats.**
- 5) Videotapes shall meet industry standards or industry-accepted standards for tape format interchange.
- 6) Videotapes must not have any visible impairments including, but not limited to, dropouts and digital errors.
- 7) VIDEO TAPE LINE-UP REQUIREMENTS

Time Code In	Time Code Out	Duration	Information
hh:mm:ss:ff	hh:mm:ss:ff	hh:mm:ss	
00:58:00:00	00:58:30:00	00:00:30	30 seconds of Black/MOS
00:58:30:00	00:59:45:00	00:01:15	75 seconds of SMPTE bars and tone
00:59:45:00	00:59:50:00	00:00:05	5 seconds of Black/MOS
00:59:50:00	00:59:58:00	00:00:08	8 seconds of identification slate
00:59:58:00	01:00:00:00	00:00:02	2 seconds of Black/MOS
01:00:00:00			Segment #1 - First frame of video begins

Note - There must be at least 1:00 minute of black (padding) after the program has finished and before the clean covers shots begin. Both the clean cover shots and the snap-in segments (if applicable) must have a slate that describes the content. Additionally, there shall be at least 1 minute of color black, silent audio and continuous time code at the end of the tape.

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

- 8) The identification slate shall be present for at least 8 seconds and contain the following information:

Series & Episode Title	CH 1 Stereo Left (Full Mix)
House # (get from PM or UM)	CH 2 Stereo Right (Full Mix)
Frame rate, aspect ratio	CH 3 Full Mix Minus Narration and Translations Left - Dipped
Date and Producer/Editor name	CH 4 Full Mix Minus Narration and Translations Right- Dipped
	CH 5 Dolby E 5.1+2 full mix
Segment 1 01;00;00 01;00;00 00;00	CH 6 Dolby E 5.1+2 full mix
Segment 2 01;00;00 01;00;00 00;00	CH 7 Dolby E 5.1 M, D & E (mix minus narration)
Segment 3 01;00;00 01;00;00 00;00	CH 8 Dolby E 5.1 M, D & E (mix minus narration)
Segment 4 01;00;00 01;00;00 00;00	(Dolby E is 1 frame Advanced on tape)
Segment 5 01;00;00 01;00;00 00;00	
TPT: 45;50 TRT: 46;50	
Program is on Time	
Credits @ 01;46;34 for 15 seconds	
Clean Covers @ 01;47;50	

- 9) All slates must contain an :10 second countdown beginning at 00:59:50:00 with an audible/visual marker at the :02 second mark at 00:59:58 (NGC can provide if necessary).
- 10) Both the label on the video cassette and the storage box shall contain the same information as the slate (see above).

4.0 Program Content

- There must not be any closed captions/embedded subtitles unless specifically requested.
- The picture must be held for a minimum of ten seconds from the end of part out point and end of program.
- A program information sheet and music cue sheet must be completed and provided for each program tape.

5.0 Video

1. Video Tape delivery shall be on either High Definition Sony HDCAM SR (5500) or Panasonic D-5 in 1280 x 720 progressive (720p) 59.94Hz (SMPTE 296M) or 1920 x 1080 Interlaced (1080i) 59.94Hz.
2. All material should be assessed for both quality and technical standards. This checks that all levels conform to the current edition of the EBU - TECH 3299 - E, which defines High Definition formats and SMPTE 274M - 2003 which details the 1080i 59.94fps and 720p 59.94fps formats. The technical assessment does not affect the quality grades given, material could have QC pass grades but still be rejected due to technical issues - Archive programs, stock footage and/or those made using NGC non-supported/approved equipment will be taken into account when assessing the material, but this does not guarantee acceptance.
3. All program levels must not exceed the following when correctly lined up to bars and tone:
 - a) Luminance must not exceed 1v (100%) or go below sub black (.3v)
 - b) Chroma must be legal in all domains i.e. RGB, YUV etc. and must not exceed the gamut limit.
 - c) Relative timings of luminance and chrominance must not exceed +/- 20 ns.
 - d) Audio levels must conform to our requirements. (See HD Audio Specifications)

Measurement reference for Gamut is as follows:

For RGB Gamut, it is 710mV on the high end and -10mV on the low end. For encoded Gamut, Luminance is from 0 IRE to 102IRE and for the peaks it is -22IRE for the lower and 112IRE for the peaks (Luminance and Chroma combined).

Please note that there are numerous quality and/or technical faults for which a program can be rejected for. If a title is rejected then full details will be provided for review.

All replacement material must have all fail points fixed and you must supply a list detailing all repairs / action taken with time codes and descriptions of all faults fixed.

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

6.0 Editing

The editing of video material must be performed on an editing system with a minimum codec of DNxHD 220X MXF 10-bit or ProRes 422 10-bit 4:2:2 or equivalent.

7.0 Safe Area and Title Safe Information

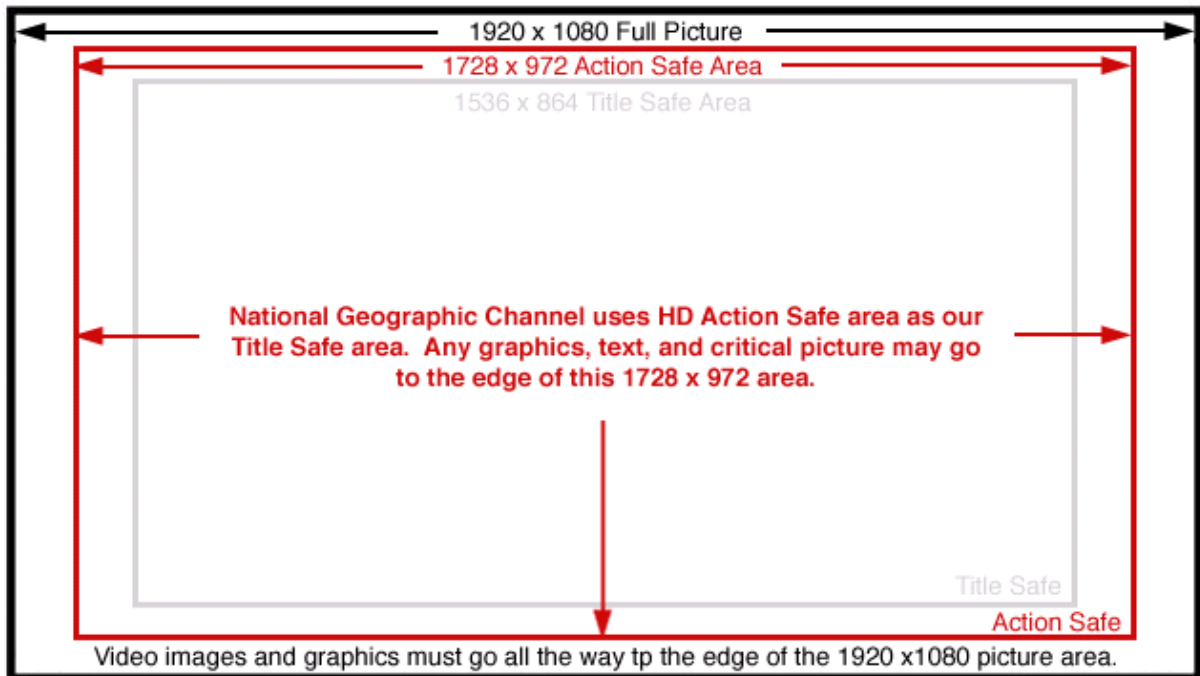
All safe action, titles/lower thirds and graphics must be correctly framed throughout to retain safe picture content. There is to be no pillar-box blanking or letterboxing footage unless previously approved by an NGC producer.

Title Safe and Image Safe

To support the aspect ratio of 16:9, please see diagram below. Do not place Chyron, or essential elements outside of the Title Safe margin of 20% from each side/edge. On the top and bottom of the screen, you can go to action safe (10%). Slight over scanning is a common practice in theatre projection and will result in loss of essential elements. Image information should fully extend to the edge of the image area. Be careful not to place vital image information within 10% of image edges. Do not extend graphic elements over black bars ("cinema bars") on letterboxed 4:3 content.

"Action safe" is the outer 10% of the ad (a box inside a box). This is similar to "bleed" in print. Never have needed information outside "action safe" (red box in diagram below), as most projectors will cut out at least some of "action safe."

"Title safe" is the next 10% in (grey area). This is the recommendation for putting all text inside. Text outside this area may or may not show up; inside the "box" it will show up. Moving or live video is not allowed in the Digital Slides portion of the program.



NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

8.0 Non-HD Footage Limitations

To enable the HD program to retain the highest quality throughout, a maximum of 10% of non-HD footage is allowed in production with no more than 1 minute of continuous non-HD footage in any sequence. Any use of non-HD material is only acceptable by prior written consent of NGC. We understand that there will be certain genres of program that will require non-HD material to be in excess of the 10% content limitation. This will only be acceptable by prior written consent from NGC.

*** Please note:**

- We will not accept any multiple resolution changes. Any exceptions must be pre-approved by NGC.
- We will only accept Up-Conversions, Down-Conversions or Cross-Conversions that have been created using a broadcast quality conversion device such as a Silicon Optics Teranex , Snell & Wilcox Alchemist Platinum Ph.C, etc. Conversions that have been performed internally by a Video Tape Machine (on-board conversion device) will not be accepted.

9.0 Film Acquisition and other formats

1. 35mm Material – Direct datacine (Telecine) transfer to High Definition of this material produces perfectly acceptable results.
2. Film based programs are encouraged to use 24fps electronic post production. For a film based or 24fps electronic production, the 24fps sequence shall be consistent throughout the material. Industry approved noise-reduction and color correction must be adhered to for all film transfers. These productions must be properly converted to acceptable NGC deliverable formats (see section 3.0 for details).
3. 8mm, 16mm and Super 16mm Material - High Definition datacine transfer of this material does not produce results that are acceptable for use with NGC HD programs. The size of the 16mm negative is too small to achieve high quality definition images. Use of 8mm, 16mm and Super 16mm film is not permitted by NGC due to concerns about quality and the long-term practical value of the asset.
4. HDV, DV and Mini-DV acquired material – High-Definition up-conversions from footage acquired using these formats does not produce results that are acceptable for usage in NGC HD programs.

10.0 Visual Effects and Footage Treatments

Any visual effects that seem to add grain or noise to acquired material requires pre-approval by NGC (sample materials must be provided). As with film and lower end digital video formats, any significant video noise or film grain will potentially create complications during broadcast.

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

11.0 High Definition Audio Requirements

- 1) Audio program material shall be produced using industry standard and accepted norms for good practice and workmanship. The audio portion of the master and source audio and videotapes must be produced so that no noise, static, dropouts or extraneous distortion is recorded in the audio. The audio mix should be well balanced and equalized, with clear dialog and narration that is not buried by effects or music.
- 2) The audio record level must be related accurately to the line-up levels recorded at the head of the tape and both are correct in preset/unity. Audio tracks must be accurately matched, correctly balanced and in phase throughout the program.
- 3) The operating level for reference tone and legacy analog system calibration is -20dBFS per SMPTE RP155.
- 4) Peak audio levels, evaluated using a digital true-peak meter with a 0ms rise response, may not rise above -10dBFS. Average peaks may not rise above -8dBFS.
- 5) The average level of dialog within the program on all non-compressed (i.e. linear PCM) content, evaluated using a Dolby LM100 Broadcast Loudness Meter or equivalent Leq(A) meter, shall return an average level of speech at -27dBFS, +/-2dB measured over the entire length of the program. The LM100 should be set to "Infinite Mode" with "Dialogue Intelligence" enabled. The measurement shall begin at the start of the program and stopped at the end of the program. The resulting Infinite Term measurement value shall be -27dBFS, +/-2dB.
- 6) Audio compression: Program audio should have good dynamic range, but not be overly dynamic. While some compression may be needed to control the dynamic range of the program audio, excessive audio compression of the final mix should be avoided as this reduces the perception of audio quality by the listener. Audio signal peaks should be approximately 8 to 10 db above program reference levels, and average loudness measurements should be comparable to reference levels.
- 7) Audio sampling rates for High Definition video masters must be at 48k at 20 bits. DA88 audio masters sampling rates must be at 48k at 16 bits.
- 8) Tracks 1 & 2 must be recorded in the correct phase relationship throughout the program, including source reference tone signals recorded for the equipment line-up purposes at the start of the tape.
- 9) The audio dynamic range of program material must be suitable for television broadcast.

11.1 Audio Channel Assignment Chart for HD Video Tape

Audio Track	Content
1	Stereo Left (full mix)
2	Stereo Right (full mix)
3	Stereo Full Mix Minus Narration – Dipped
4	Stereo Full Mix Minus Narration – Dipped
5	Dolby E 5.1+2 full mix
6	Dolby E 5.1+2 full mix
7	Dolby E - Mix Minus Narration - Dipped
8	Dolby E - Mix Minus Narration - Dipped

* For further details on individual audio channel break-outs and configurations, please see section 11.4 & 11.6

11.2 Audio Sync for non Dolby tracks

Sound and Vision should be delivered fully frame synchronous throughout the program for the stereo only tracks on channels 1 & 2 of the video tape. DA88 tracks time coded tracks must also match the video tape. In no circumstances may audio and video be out of sync by more than one field (i.e. 20 ms). [Dolby audio tracks are addressed in section 11.4]

11.3 Noise Reduction in Digital Recordings

Digital Audio recordings shall be supplied without digital noise reduction or pre-emphasis.

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

11.4 Dolby E

- 1) The Dolby E encoded data of the full mix shall be recorded on AES-3 (tracks 5/6) of the Hi-Definition video tape and the encoded Dolby E data of the M,D & E on AES-4 (tracks 7/8).
- 2) Dolby E encoded data shall be recorded such that the encoded data stream on tape is one frame delayed of video. This requires that the audio be advanced two frames with respect to video during Dolby E encoding.
- 3) The Dolby E program configuration shall be set to 5.1+2, and the channel configuration within the Dolby E data stream shall be as follows:
 - Ch1 – Left (Music & Effects, location dialog that does not appear in the center channel)
 - Ch2 – Right (Music & Effects, location dialog that does not appear in the center channel)
 - Ch3 - Center (Narration, location dialog)
 - Ch4 – Low Frequency Effects (Explosions/Music Effects)
 - Ch5 - Left Surround (Ambience & Effects)
 - Ch6 – Right Surround (Ambience & Effects)
 - Ch7 – Left Total
 - Ch8 – Right Total
- 4) The measured value of speech within the full multichannel mix (both the 5.1 program and the stereo "+2" program) shall be -27dBFS, +/-2dB, and the Dialogue Level parameter (a.k.a. the "dialnorm value") within the audio metadata shall accurately reflect this measurement (see section 11.5). The Dolby LM100 Broadcast Loudness Meter (or equivalent Leq(A)meter) shall be used to evaluate and measure the average A-weighted level of speech within the program.
- 5) Dolby E M, D & E data streams containing no narration shall carry the same dialnorm value of -27 as the full mix.
- 6) Audio compression: Program audio should have good dynamic range, and provide a compelling surround environment to the home listener. While some compression may be needed to control the dynamic range of the program audio, excessive audio compression of the final mix should be avoided as this reduces the perception of audio quality by the listener. Audio signal peaks should be approximately 8 to 10 db above program reference levels, and average loudness measurements should be comparable to reference levels.
- 7) When available, a Dolby DP570 Multichannel Audio Tool shall be used during the mastering of the Dolby E data stream to ensure correct settings of audio metadata parameters and to best emulate a home listening environment.
- 8) Audio sampling rates for High Definition video masters must be at 48k at 20 bits. DA88 audio masters sampling rates must be at 48k at 16 bits.

11.5 The recommended Dolby E audio metadata settings are as follows:

Parameter Name	5.1 Channel Program	2/0 Channel Program
Dialog Level	-27	-27
Channel Mode	3/2	2/0
LFE Channel Enable	On	N/A
Bitstream Mode	Complete Main	Complete Main
Line Mode Profile	Film Standard	Film Standard
RF Mode Profile	Film Standard	Film Standard
RF OV Protect (if present)	Disabled	Disabled
Surround Phase Shift	Disabled	N/A
Center Mix Level	0.707 (-3.0dB)	N/A
Surround Mix Level	0.707 (-3.0dB)	N/A
Dolby Surround Mode	N/A	Dolby Surround
Surround 3dB Attenuation	Off	N/A

- 1) Dolby Digital audio metadata shall be enabled, set and carried within the Dolby E data stream. A printout of the audio metadata settings shall be included with the video tape submission.
- 2) Audio metadata shall be generated by a Dolby DP570 Multichannel Audio Tool or equivalent when available.

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

11.6 DA-88 Digital Audio Master

Separate audio master tapes are to be delivered for each Program Master Video Tape. The DA-88 must be in sync with matching time code of final program master. DA-88 tapes are to be delivered at **Final Constant Level** (i.e. will re-create final mix, without dips for narration, using fixed pre-set fader positions) on separate tracks or as follows:

Audio Track	Content
1	Music Left
2	Music Right
3	Effects Left
4	Effects Right
5	Narration
6	Dialogue
7	VO / Voice of Translator
8	Open

DA-88 Digital Audio Master of Dolby Tracks

Audio Track	Content
1	Left (Music & Effects, location dialog that does not appear in the center channel)
2	Right (Music & Effects, location dialog that does not appear in the center channel)
3	Center (Narration, location dialog)
4	Low Frequency Effects (Explosions/Music Effects)
5	Left Surround (Ambience & Effects)
6	Right Surround (Ambience & Effects)
7	Left Total
8	Right Total

Note – We will use the tracks on these two DA88 audio tapes to make all necessary changes involving narration and/or Mix and Layback modifications. They are not to be Dolby E encoded. These are the audio elements that are already being used to create the Dolby E stream.

Tracks are to be recorded at final mix levels, without dips for narration or translations.

On and off camera sync dialogue: Defined as any character dialogue which is sync-to-camera or voice over. NGC has reserved the term "dialogue" for foreground human speech that advances the story and/or provides information to the viewer but which is not uttered by the narrator. This definition covers two types of dialogue: on-camera sync by a character; and off-camera voice-over by a character. Dialogue consists of a character's natural voice, no matter what language he/she speaks. Translation voice-overs are a separate classification, closer to narration than dialogue, and should therefore occur only on channel 7 (VO/Voice of Translator). The dialogue track is both mono and constant level.

12.0 Time Code

- All program material shall have SMPTE DROP FRAME time code of continuous ascending numbers.
- LTC must be recorded on the designated track at a flux level of 100 nwb/m corresponding to 0db (4ppm)
- Time code must be locked to video and must be continuous throughout the tape, including the line-up section and any breaks.
- The time code for the first frame of the program must be 01:00:00:00. VITC must match LTC throughout.

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

13.0 Graphics Master and Log

- All graphic elements necessary to customize graphic sequences for non-English text for the international market must be included on this tape. A time-coded log of the graphic master must be included with the Graphic Master tape. A copy of this Graphic Tape log is to be delivered with the Production Element Binder. ** If time allows, Program Graphic requirements may be added to program tape. Elements should include, but not be restricted to:
 - Fully composited animation (all elements) with 3-5 seconds of pad at the head and tail. Pad can consist of the first and last frame of the animation held as a "freeze frame", or more appropriately, 3-5 seconds of extended animation at the head and tail to allow for transitions.
 - Title Elements with mats – should be a key-able title, not just a type treatment.
 - Full open with clean resolve without title logo.
 - Any animated moves, including all layered pieces. All elements or layers including, but not limited to: type, political borders, locator dots, mattes, etc.
 - Credit bed – clean of text graphics/supers, formatted to NGC's specifications. Exact length of credits are :15 seconds.
 - All computer models.
 - 2D Artwork – Provide Photoshop file format or JPEG. If 2D art is created in Photoshop with multiple layers, provide files in Photoshop format with layers intact. All other textures or still images must be delivered in TIFF file format.
 - Animation – If After Effects is used, provide all related files. Provide all 2D animated textures at full resolution in QuickTime Movie format using "animation codec with no compression". Animation rendered on fields at 29.97 frames per second at a resolution of 1920 x 1080 for 1080i & p and 1280 x 720 for 720p is required.
 - All live action, chroma key/blue screen, and associated matte media.
- 5 seconds graphic elements suitable for creating bumpers with a 5 second music sting. IF APPLICABLE, 10 seconds static graphic bed for use as credit back plate with a 10 second music piece (please note: only 7 seconds to be used in most cases).

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

14.0 Video Deliverables Specifications for CGI selects

14.1) CGI (Computer Generated Images) Stills: (*if applicable* - lower rez due at Fine Cut and high rez Pic Lock) If CGI is an important element in explaining or depicting the topic or content of a program, ten (10) – fifteen (15) low resolution (72dpi) frame grabs should be delivered per episode at fine cut. We will then select approximately five (5) which should be rendered high resolution for delivery at Picture Lock. All high resolution images should be rendered at 300dpi 14.2"x8" (or 4267x2400 pixels) TIFF files.

Content:

- Content of the images will vary depending on the film. The images should either capture or explain the subject matter or topic of the film or clearly film the technology used in the film
- The images are used in aid of the Channel's printed marketing efforts around the film. Therefore, the images need to be higher quality than HD resolution.

Specifications:

- CGI Images should be delivered with an electronic copy of the "CGI Digital Images Informational Sheet," and be cleared for domestic promotional usage
- Since these images are used for print purposes the preferred specs are: 300dpi, minimum 14.2"x8" (4267x2400 pixels) TIFF files
- All CGI images are to be delivered on a CD/DVD and clearly marked
- For the high resolution images we will not accept images that are not fully rendered, not fully textured, lo-resolution or standard-def resolution, or images rendered with interlaced fields
- Alternately, we will accept 1920x1080 pixel HD TIFF files at 72 dpi, however these images do not hold up for print purposes and decrease the likelihood of using the images to promote the film

14.2.) CGI (Computer Generated Images) Selects: (*if applicable* - due at Fine Cut) minimum of five (5) – seven (7) minutes of CGI footage per episode per one hour program delivered on Digital Beta (4x3 or 16x9 NTSC video).

Content:

- We prefer to use CGI for episodic topicals and specials promotions because the content is different/scientific/unique and not-stock-film-looking. The CGI selects are often the most important deliverable
- The more CGI, the better. These scenes are often the most dynamic and modern looking shots from many films, and are wonderful marketing tools to speak to the unique promise of the film

Specifications:

- CGI Selects should be delivered with an electronic copy of the "CGI Selects Informational Sheet," and be cleared for domestic broadcast/promotional usage
- Due to usage of CGI materials, delivery of episodic selects (CGI for series episodes) should be made no later than 21 days prior to air
- For priority specials and one-ups, CGI materials should be delivered no later than 45-60 days prior to air (these specials get one month of promotion, hence earlier delivery)
- Footage can be delivered anamorphic for conversion (preferred method of delivery) or letterbox 16x9
- We will not accept CGI selects that are: in PAL format; low resolution or unrendered imagery; third generation or more dubbed materials; footage that is too dark; time code burned into the clip

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

15.0 References

ATSC A52: Digital Audio Compression (AC-3)

EIA/CEA 608B: Line 21 Data Services

EIA 708-B: Digital Television (DTV) Closed Captioning

SMPTE RP 155: Audio Levels for Digital Audio Records on Digital Television Tape Recorders

SMPTE RP 207: Transport of Program Description Data in Ancillary Data Packets

SMPTE RP 218: Specifications for Safe Action and Safe Title Areas for Television Systems

S MUTE 1 2M: Time and Control Code

SMPTE 59: Camera Aperture Images and Usage

SMPTE 96M: 35mm and 16mm Motion Picture Film — Scanned Image Area

SMPTE 274: 1920 x 1080 Scanning and Analog and Parallel Digital interfaces for Multiple Picture Rates

SMPTE 279M: 1/2-inch Type D.5 Standard Definition Component Video and Type HDD5 High-Definition Video Compressed Data

SMPTE 292M: Bit Serial Digital Interface for High Definition Television Systems SMPTE 334M: Vertical Ancillary

Data Mapping for Bit Serial Interface

SMPTE 342M: HD-D5 compressed Video 1080i and 720p Systems Encoding Process and Data Format

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

16.0 1080 Camera Technical Specifications

All HD 1080 Interlaced and Progressive Scan programs must adhere to SMPTE rules:

- SMPTE 274M-2003
SMPTE Standard for Television - 1920 x 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates.
- RP211-2000
SMPTE Recommended Practice – Implementation of 29.97 and 59.94 Segmented Frames for 1920 x 1080 Production Format.
- SMPTE 292M-1998
SMPTE Standard for Television – Bit-Serial Digital Interface for High-Definition Television Systems.

Suggested cameras are the Sony HDW-F900R or the Panasonic Vericam AJ-HDX900

Minimum Requirements for all cameras shooting in 1080 format

Item	Minimum Requirements
Pickup Device	3-chip 2/3 inch FIT CCD (16:9)
Aspect Ratio	16:9
Frame Rates	59.94i, 29.97P, 24P, 24P Advanced
Picture Elements	2 million pixels
Gain Selection	-3, 0, 3.6 and 12 dB
Sensitivity	f 10 at 2000 lux (3200 k, 89.9% reflectance)
ClearScan Selection	60.1 ~ 7000Hz
Extended ClearScan	30.4 ~ 58.3Hz
S/N Ratio	54dB (HD output)
Horizontal Resolution	1,000 TV lines/ph
Registration	Within 0.02% all zones (without lens)
Modulation Depth	45% at 800 TV lines/ph (27.5Mhz in HDTV)
Compression Ratio	4:2:2 In and Out
Shutter speed selection	1/100, 1/125, 1/250, 1/500, 1/1000, 1/2000 (s)
Dynamic range (1080/60i mode)	600%
Frequency response	Within ±0.5 dB, 10 to 25 MHz Within ±1.0 dB, 25 to 30 MHz
Quantization	10 bit

NATIONAL GEOGRAPHIC CHANNEL US HIGH DEFINITION TECHNICAL SPECIFICATIONS

17.0 720p Camera Technical Specifications

All HD 720 Progressive Scan programs must adhere to SMPTE rules:

- SMPTE 296M-2001
SMPTE STANDARD for Television – 1280 x 720 Progressive Image Sample Structure – Analog and Digital Representation and Analog Interface
- SMPTE 292M-1998
SMPTE Standard for Television – Bit-Serial Digital Interface for High-Definition Television Systems.

Suggested cameras are the Sony HDW-750 or the Panasonic Vericam AJ -HDC27FP

Minimum Requirements for all cameras shooting in 720p format

Item	Minimum Requirements
Pickup Device	3-chip 2/3 inch FIT CCD (16:9)
Aspect Ratio	16:9
Frame Rates	59.94P, 29.97P and 24P
Picture Elements	1 million pixels
Gain Selection	-3, 0, 3.6 and 12 dB
Sensitivity	f 10 at 2000 lux (3200 k, 89.9% reflectance)
ClearScan Selection	60.1 ~ 7000Hz
Extended ClearScan	30.4 ~ 58.3Hz
S/N Ratio	54dB (HD output)
Horizontal Resolution	700 TV lines/ph
Registration	Within 0.02% all zones (without lens)
Modulation Depth	45% at 800 TV lines/ph (27.5Mhz in HDTV)
Compression Ratio	4:2:2 In and Out
Shutter speed selection	1/100, 1/125, 1/250, 1/500, 1/1000, 1/2000 (s)
Dynamic range (1080/60i mode)	600%
Frequency response	Within ±0.5 dB, 10 to 25 MHz Within ±1.0 dB, 25 to 30 MHz
Quantization	10 bit