NaSTA 19 - Talk for NON Techies- the Future technologies
– and a look from the past

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www.smpte.org/uk
Look for NaSTA in the sidebar for these slides
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What are SMPTE’s features

• Membership organisation almost 8000
• International with 1/3 members not in USA
• Not a charity – USA Not For Profit
• Covers all Moving Images Audio and Metadata
• Has Members – is run by members not staff
• Delivers Education
• Sets Standards “set in Stone” almost

SMPTE in the UK serves all who are working with the technology of moving pictures and associated sound & metadata
– creatively, practically and innovatively
in any format, and
on any platform

www.smpte.org/uk
Who are you?

• Subject?
  • Arts
  • History/Geography
  • English
  • Non English Languages
  • Theology
  • Law
  • Science
  • Technology /Computer Science
  • Engineering
  • Maths
  • Medicine

Which station /University ?

What role ?

• In front of camera
• Behind camera
  • Prod/ Direction
  • Craft
  • Engineering

And me!

• Scripted an entire Blue Peter
• Produced and Directed items for “Tomorrows World”
• Produced wrote directed edited BBC Trailers and Eng. recruitment
• Was a BBC Official spokesperson on Sex and Violence in Programmes
• BBC Exec Producer for Audio Description
• Chaired the first Broadcaster meeting in 2003 for World Cup 2010
• Did the risk assessment for “Otis the Aardvark dressed as nun on skateboard on the ring road”

• Has qualifications in
  • Electrical Engineering (KCL)
  • Theology (KCL)
  • Management specialising in Corporate Strategy (Uni Of Westminster)
  • Group Psychotherapy (Birkbeck)
• Has been organising meetings for IEE/IET/RTS / SMPTE for over 45 years
• Wrote first letter to The Times on “Engineering our Future” in 1980
• Served on Council of IEE and the Board of Governors of SMPTE
• SMPTE Fellow 2017 peter@weitzel.com
More about Weitzel

- Knew that he wanted to work “behind the camera when 7 years old
- First paid by the BBC when 14 years old (51 years ago)
- Joined BBC in 1976 – and has worked in Projects/ Strategy 1978-2010
- Installed first GVG Vision Mixer in PAL (and it had a NEC DVE) costs £800K in 1980
- Designed installed studio with very software controlled Vision mixing system for BBC Sport
- Led teams installing new core systems in BBC Nations and Regions – while also going stereo and about 5 other projects
- Led the international standardisation of Teletext in various forms including the worlds first open standard EPG (& PDC)
- Major author of DVB Subtitle standard
- Developer, Editor and Implementer of Audio Description in the UK
- Co wrote the BBC Technology Business plan
- Working with Video and Audio over IP in 2000
- TDA for BBC broadcast connectivity 20 years
- Consulting for major International broadcasters
- Project Director first international UHD2 transmission (“8k”) 2008 (MPEG over IP)
- Mentored over 200 trainees

Agenda

- The Past - what I have seen and led
- The Present – say the past 10 years
- The Future – what you will be seeing and leading
- Your Future – get yourself involved!
The Past – when I was your age

• Three analogue terrestrial SD TV channels
• The Future “is Digital” – what ever that meant but the BBC and itv were broadcasting “digits to the home”

The BBC and ITV did everything themselves –
Few facilities houses and very few Production Companies
Lots of small (UK) Manufacturers

The Past the 1980s

Still very analogue - but digital islands – like Quantel
Microprocessors gaining traction – but most control still wire per function.
But SMPTE work on ST 259 “Rec 601” SDI (1982)
And IBC 1989 – “the year of HD”
I did – Pres A and TC5 for BBC Sport
And Ch. 4 ;launched ...
The Past the 1990s

The decade of emission charging – PAL plus, Assorted MACs
HD failed – hence MPEG ...
The launch of DVB
And UK DTT first in world 1998 and DSAT say 200 channels
But also digital stereo audio on analogue TV NICAM
HD SDI ST292 in 1998 (it won EMMY in 2013!!)

I was doing Nations and regions / Net IDs/ Stereo/
Much work on Teletext– after all that had Digital since 1970s!
And DVB ST and EPGs etc.

Metadata was “discovered”

The Past – 2000

• Start of IP in broadcasting
• MXF ...... And into DCP
• UHD2 Is here in 2008
• HD emissions – 2005 onwards
• HD SDI is normal for new installations
• Electronic cameras for “film”

BBC TX sold BBC OB sold  Red Bee Sold BBCT Sold  etc.
Itv mergers
Independent production becomes (almost) the norm
The Present 2010++

Lots more broadcasters - looking at just a few ......

BBC outsources
All Production except News and all London playout
All technical except Code & Mux SatOps connectivity (back in house)
And News (and N&R) Studios and Newsgathering
ITV is the biggest Independent producer in the USA
And Outsources all Playout and has little in house technology
SKY – does lots of things in house – only OB in tech area outsourced
And is the UK second largest ISP with over 1/3 Domestic connections
BT – is the UK largest ISP with over ½ connections – and runs IPTV and BT SPORT
And then even more streaming – it’s a lot more than Netflix

The Present – 2010 ++

• IP comes along
  • SMPTE ST 2022- family (SDI over IP)
    ST 2110  Component video Audio Subs metadata and NMOS
  • AS11 DPP etc. for File delivery – and adoption by NABA
  • IMF – Component Video Audio Subs Metadata etc. for Files
• HDR WCG HFR as part of UHD ...
• Bigger better cheaper universal connectivity .....5G
• Virtualisation... Clouds
• Machine learning AI etc.
• AR MR VR etc. ....gaming
The Future is IP

Internet Protocol is a Everywhere – ubiquitous
TCP-IP works fairly well for File transfer
UDP works fairly well for Streaming
The Equipment being mass produced is cheap
Thus lots of COTS kit available and Commodity systems are cheap
Lots of people would work with IP –thus (cheap??) Staff
Software is everywhere

Broadcasters have some specialist requirements
Files are very large and thus needs acceleration to move
Uncompressed video is UDP Multicast at Gbit/sec and requires constant low latency
Thus equipment is COT Top Shelf
Very few people actually understands at the “every packet counts” level....
There is no place for resend
........................or just delay a bit!
Even for files!

Component Essence

ST2010 handles videos audios and metadata as separated flows over IP
“No embedding”
Picture is Only active video
No blanking so 1.04Gbit/s in HDSDI
Image size up to 32k*32k
Y’Cr’Cb’, RGB, XYZ, I’Ct’Cp’
4:2:2/10 4:2:2 /12 4:4:4:4 /16 and More
Both PQ and HLG
BUT needs NMOS IS-04 and IS-05 to Discover and register equipment and Route signals .... And ST 2059 PTP to time!

IMF ST2067 handles videos audios and metadata as separated MXF files in an object environment .
Take the Original version at the highest quality
And the save only the differences of what makes up that version
Composition Play List CPL (ship elements PKL)
And a “This technical format” Output Play List OPL
a) To make versioning/ localisation of films easy (J2K)
b) To provide a way of shipping the required content to and from POST house
c) ...... now Makes TV + Digital Production easier  ProRes TSP2121
d) And may Replace AS11 delivery
What's versioning / Localisation

A typical Feature film has over 700 versions
With various audios technically - stereo 5.1. ATMOS
as well as language/market
and subtitles in more languages than the audio!
As well as different cuts of the video to reflect the local cultural requirements

IMF the intelligent bucket

If I have the OVV and OAV
Then to make a French Canadian version I need a package which is

- CPL French Canadian
- Plus
- Titles (fr) video
- Credits (fr) video
- Snippets French and Canadian
- French Canadian audio

..... A very small set of files

And that set also does English and French!
Better Pixels ...... And more of them

High Dynamic Range
Whiter whites – Blacker Blacks
https://www.itu.int/rec/R-REC-BT.2100
Two Main Systems
PQ – Dolby – Display referenced – Cinema
HLG – BBC/NHK – Scene referenced – TV+
https://www.itu.int/pub/R-REP-BT.2390
interchange at 1000nits

Wider Colour Gamut
More lifelike colours
https://www.itu.int/rec/R-REC-BT.2020/en
Linked with More Pixels
UHD1 – 3840 *2160 Marketing says 4K
UHD2 – 7680*4220 ......SHV “8K”

High Frame Rate
Better Motion representation

Real World Light Examples
Light units are in candela/m², more conveniently spoken - “Nits”

133,000 nits
170,000 nits
300,000 nits
0.25 nits
15 nits
15 nits
300 nits
6000 nits
10,000 nits
185 nits
Rationale for Enhanced Color Gamut

Surface color of real objects often lie outside HDTV gamut (Rec. 709)
... but mostly within the UHDTV gamut (ITU-R Rec. BT.2020)


Shooting at Higher Frame Rate

- 48 FPS (1/60 of a second)
- 24 FPS (1/48 of a second)
- 60 FPS (1/120 of a second)

180°
Connectivity – Remote Production

What makes it all work - where the techies live

Equipment
Pictures and Sound
Comms and control + Rev Video

Control Room
Prod / Dir & mixing staff
what pictures sound is output

Say Dual path say 50 Gbit/sec carrying 24++ Cameras each at 1.5 Gbit/sec “NO DELAY”
Connectivity – Remote Production

What makes it all work - where the techies live

Control Room
Prod / Dir & mixing staff
what pictures sound is output

Internet or 5G in future (4G now)

Equipment
Decompress
Comms + Rev Video

Pictures and Sound

Compress

Cameras anywhere

A

B

C

With techniques like Suitcase TV
Iframe ALL CONTENT time
Aligned -- and Equipment anywhere

Say < 2secs

Compress

Compress

Compress

Virtualisation and Microservices

As most processing is in software – why not “buy” it when its needed ...
From where ever it is? (e.g. Cloud)
BBC iPlayer regional news
Experimental Playout etc.
Some editing.......

.......ordinary Streaming play out

But why not Grade etc.
if get IMF Package into a cloud???

Commercial Issues
PAYG – but who is taking risk?
Turn off when not using
Cost of “getting out” of the cloud – “getting in” is usually very low cost!
Whose cloud are you in ???

Microservices – the techies way of keeping up to date by constantly doing
minor modularised updates
Machine Learning (aka AI)

You need to Teach the system what it should be doing ... Get that Right
But how does it – it works out itself! – but how correctly ???
And all of these routine work could be done by ML (and many are)
• Speech to Text (& vice versa) (over 25 years)
• Object recognition –
  • Simple – dog / cat / horse
  • Complex – Buckingham Palace
• Face recognition

• Dialogue recognition
  • Language detection

• Object tracking
  • Object replacement
  etc. etc.
All Major tech companies have open source libraries – as almost every industry can use ML

Deep Learning Analytics
All metadata about your viewers

It is the real thing? AR MR & 360deg

Virtual Reality
– may live in Games
And obviously in Animation

But Mixed or Augmented Reality may be the future
Aided by ML object detection

360 dig video is NOT VR

But the one thing that is common in all of this is how do you render the images quickly to the headset ....
And what about the Audio!!?
Questions??

For answers - look at www.smpte.org/webcasts
Or come to a SMPTE meeting or read SMPTE Motion Imaging Journal
Also good sources
https://mrmxf.com/shorts/
Or Contact me Peter@weitzel.com

The Industries and Jobs

It was just the BBC and a few other Broadcasters
Or the manufacturers – it is now a lot more complex and BIGGER
Or Who makes or commissions Professional content?
Basic Sector grid of the Industries

<table>
<thead>
<tr>
<th>Creative</th>
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Notes:

Many Industries - not one!
The large Services sector may be split to cover wide spectrum from “Adverts” VFX via POST = Creative

Through
OBs to Transmitters (Service Providers) and Systems Integrators = Technical

Note some are “not Media and Entertainment field”
But still the “art and science of the moving image”

And that engineering skills like numeracy and being organised work anywhere!

See a lot more in “formation of UK Section” In

Skills you need

• Working effectively both individually and collaboratively as part of a team
• Ability to communicate clearly and concisely using appropriate discretion
• Build and maintain positive relationships with colleagues, customers and suppliers

• Demonstrate a passion for the broadcast media industry and its productions
• Display a strong work ethic and commitment.... And understand being timely
• Work accurately with a high degree of attention to detail whilst maintaining a wide overview
• Think creatively and logically to solve both technical and creative issues (remember fundamentals)

• Contribute to a process continual improvement of workflow and technique
• Proactively keep up to date with latest developments within the industries

• Uphold ethical and professional standards & Maintain company and customer confidentiality

From www.riseweib.com
Non Modo..... Sed etiam

The skills seem to be opposites.....
• You need to have a breadth of view and experience - NaSTA is good at this!
...... And grow them – Don’t just sit in the corner!
There is a assumption that you will grow / keep up to date
You will move across the industries doing different jobs / roles for many employers (and clients)
• So look beyond the Television (technology) space – to the business /wider issues
Enjoy it – Broadcasting/ the Media/ Technology is fun!

Some quick Points

• All 3 Media employs more Producers in UK than all BBC Group
• ITV is the largest Independent Production company in the USA
• Streaming Video makes up 85% of Internet Bit rate
• Anyone can broadcast from their phone

Human Civilisation has been built on story telling :-
Whether the Truth of the News
Or the Fantasy of Human Imagination
The Power of Broadcasting

“Dawn .. And as the sun breaks through the piercing chill of night on the plain outside Korem .. It lights up a Biblical Famine
Now in the Twentieth Century .....

Michael Buerk BBC News 23 Oct 1984

https://youtu.be/XYOj_6OYuJc?t=44

“It's twelve noon in London, seven AM in Philadelphia, and around the world it's time for Live Aid.

Richard Skinner Saturday 13 July 1985

https://www.youtube.com/watch?v=8a1ZP6gJ3fK

One of the largest-scale satellite link-ups and television broadcasts of all time; an estimated audience of 1.9 billion, across over 150 nations, watched the live broadcast, nearly 40% of the then world population

AT THE SAME TIME

https://www.youtube.com/watch?v=eEO6v-YfS00

... And your challenge

I’ll share your story far and wide .... ..... The Future is not yet written , but I’ll make sure it is Ours

https://www.youtube.com/watch?v=ldpsplIWI2o
www.smpte.org/uk
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Graduates

Graduates need Industry involvement
To find out what is going on in the industries and thus where there are opportunities/ Jobs so that you can have as good career progression/satisfaction by having as much fun as everyone has had in the past 90 years!
Or I have had in past 50 years or so
So get involved now.....
SMPTE for Techies

The Industries need Graduates
As there are so many new technologies needing new minds to solve the problems – and new ideas – the member need to learn from you as the experts in tomorrows technologies and making compelling content
.... You are the Industry of the Future
So get involved now.....
SMPTE for Techies