NaSTA 20 - Talk for Techies-
the current future tech and opportunities
– and some learning from my career

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Hon Sec Treasurer UK Section 2012-18
International Membership Director 2015-17
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

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Who are you?

• Subject?
  • Science
  • Technology /Computer Science
  • Engineering
  • Maths
  • Medicine
  • Law - CTO Pinewood read Law at Nottingham Uni
  • Arts
  • History/Geography
  • English
  • Non English Languages
  • Theology

Which station /University ?

What role?

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

What about Weitzel?

• Knew that he wanted to work “behind the camera when 7 years old
• First paid by the BBC when 14 years old (52 years ago)
• Joined BBC in 1976 – and has worked in Projects/ Strategy 1978-2010
• Installed first GVG 300 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
And also

- 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
- Did the risk assessment for “Oti 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

Agenda

- The Technologies you will be working with ...
- Some things I have learnt – and you need to be aware of
- What are the TV Industries – and it not just Media!

............. So where can you get jobs!

Last Year – Past Present and Future
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

Today is IP ....and has been for years

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
BBC has had AoIP for 20 years
ST 2110 – Component Essence

It 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

ST 2110 = IP version of Double ended cable

Where does each end fit?
And if equipment is virtual – how do you know that it is there?
Discovery
– and note where it is IP address
Registration
Advanced Media Workflow Association AMWA
Networked Media Open Specification NMOS
https://www.amwa.tv/nmos
IS-04 Discovery and Registration

Having found the equipment......
then join it up
IS-05 Device Connection Management
Then Provision Network (SDN)
IS-06 Network Control

And going on ...
IS-07 Events and Tally
.......... And coming soon IS-08 audio groups
NMOS is essential!
AES67

Like SMPTE ST2110 relies on PTP IEEE1588
Slightly different to ST 2110-30
Which is a tighter profile...
But practically the same.
took about 15 years from first Ideas
To finished spec.....
Via a lot of incompatible single manufacturer solutions

Like ST2110
– Its just a XLR double ender
Industry de facto works using Dante® www.audinate.com
For Discovery Registration and Routing
….. But Dante® audio is AES67 now

IMF Interoperable Mastering Format
ST 2067

Designed to solve two problems

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) Makes TV + Digital Production easier
   ProRes TSP2121
d) May Replace AS11 delivery in UK
e) And is how you deliver to Netflix
f) Being developed for TWO videos - Signing

Take the Original version at the highest quality
And the save only the differences of what makes up that version
Plus
Lists to say how to make the version you want .....
Composition Play List CPL
(shipping elements PKL)
And a “This technical format”
Output Play List OPL
What’s versioning / Localisation

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

BUT Just store OV and the differences – with the “how to make” – a lot less storage needed say 30 times https://mrmxf.com/shorts/

Objects

Story telling
The ‘objects’ refer to the different assets that are used to make a piece of content. E.g a scenes in a drama or a caption
By breaking down
• a piece of media into separate objects,
• attaching meaning to them, (metadata)
• describing how they can be rearranged, (metadata)

a programme can change to reflect the context of an individual

Technical
Individual components Video Audio Subtitles/text with (technical) Metadata
Linked together by a list SDP or CPL
More metadata
Referenced by a Unique ID (UMID) even more Metadata (very techy)
If stored – in a non File system structure
If streamed - time alignment matters PTP RTP
Deliver Objects plus the lists to get the output!
Today & next years

• Better Pixels and Sound
• Connectivity even more!
  • 5G for emission
  • 5G for contribution
• Remote Production
• Virtualisation
• Microservices
• AI ML
• AR MR
• And the greatest challenge...???

Future of the BBC.....
It does a lot more than just TV!
... And FAANGs do etc...
Promotes UK culture
Worldwide reach in radio TV and web - and Film!
Training and R&D ... Industry leadership
>16% of UK Media Market
It has more commercial channels in UK than PSB – & Four News 24/7
Find out what it does!

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
And Immersive Audio
Connectivity .......

>10Gbs IP interconnect affordable for Uncompressed/ Mezzanine (100G is a standard product NOW)

>= 1 Gbs affordable too and from most cities in the world

Some things are clever SMPTE VC-6 ST2117
Dynamically changing coding .... 8 signal box
https://www.v-nova.com/p-link-video-encoder-and-decoder/

>30Mbs Internet universal almost world wide

.... And IP is bi directional

............And IP is media type agnostic

There has always being a triangle of Processing Storage and Connectivity to get a signals from one place to another —

If you can store it you can send it over a low bit rate link slower than real time

if you can process it you can compress it so it uses fewer bits because

Connectivity was never enough bit rate, if you had it, it was expensive

...... and TV was going SD to HD, ...., to UHD

But it has changed fast — in under last 7 years but Processing (with Storage) is still needed

Pricing can be very different from conventional

Cost = Bit rate*distance

BT UK Now is Cost = Bit rate

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5G – a lot of hype !!

Emission

Broadcast mode for IOT mostly not Media Broadcasting –

Emission on DVB will end in 2030s BUT lots of UDP capacity for streaming –

And enough in one cell goes B’cast

And BBC / PSBs + a few will “broadcast” Few may be “UKTV” Sky Sports BT Sports

Contribution

Lots of low latency capacity —may be exploit beam steering for broadcasters.

...... But lots of fibre needed- PON!

BUT it is not >1Gbit/sec everywhere (unless its on every lamppost — and there may be a fibre there!)


Why Huawei? — limited 35% Non core Beam Steering Antenna others Ericsson and Nokia — have not got this yet.. Note NO USA companies (or UK or Japanese etc.. S Korea may be)

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Remote Production

At its simplest – uses telco connectivity to replace camera cables.

EPL – Cameras @ venue ST2022-6 to Mixers @ Stockley Park (IMG)

But can also put the mixer at the venue and control it remotely...
And with timestamping - latency is not a problem see NaSTA 18 slides and
https://www.smpte.org/sections/united-kingdom/events/remote-production-over-ip-networks

Minimum on site staffing
• Less travel (and CO₂)
• Lower Hotel Bills
• Less Time away from Base
Consistent Look and Feel from Central production team
As it is cheaper – more output e.g. minority sports
....... And NaSTA stations using it

Remote Production

But it can be more complex:-
SailGP – Australia (220/250ms)
Camera racking Vision mixing EVS in Ealing!
https://www.timeline.tv/2019/08/sustainability-a-key-factor-as-sailgp-races-to-remote-production/

Blue Planet Live
Baja, Mexico; the Bahamas; Gt Barrier Reef mix of flyaway and Remote
https://www.timeline.tv/2019/03/timeline-supports-bbcs-blue-planet-live/

Remote Cameras –
They can fit where others cannot get
Like Yachts
Jungles and Deserts
Royal Weddings
Virtualisation – Virtual Machines VM

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

And ordinary play out ... Streaming
All the more so if you can load IMF and make an AS11DPP in the cloud (as cinema does with DCP)
Or just play out from ProRes/J2K CPL/OPL
OR Grade or edit or .........

Technical issues
easy to provision – particularly in public cloud
Very flexible – can be spun up and spun down often in less than a frame
Hence resilient!
Various processors CPU GPU etc.
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

How can you efficiently and reliably and transparently upgrade the programs your VM is running ?
If the software is made up of small modules with clear interfaces (APIs) .. Aka Microservices

Then you can upgrade test and deploy frequently ....
- if you don’t change much at any one time

Getting typical Open and Specified or Standardised APIs in Broadcast Microservices is the latest bit of work in SMPTE standards/ interoperability

If you are interested
Bruce@mrmxf.com
..... A final year project perhaps!
Machine Learning (aka AI)

**Machine learning** (ML) is the study of algorithms and statistical models that computer systems use to effectively perform a specific task without using explicit instructions, relying on patterns and inference instead.

You need to Teach the system what it should be doing ... But how it does it – it works out itself!

A vast subject with a vast set of uses

Speech to Text (and vice versa)
Object recognition
Face recognition
Dialogue recognition
Object tracking

Deep Learning Analytics
All metadata about your viewers

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**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

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!!?
And the greatest challenge ....

“Invented” in the early 1990s
By Carol Owens and others at the BBC
Enables you to know what you have ......
AKA – the Bits about Bits

Without it ......
You cannot make a programme – its in an Edit decision list and more
Cannot deliver a programme - It is in AS11DPP and Netflix spec
The viewer cannot view a programme
- it is in the EPG to help select and then in DVB, ATSC and all the streaming protocols
You don’t know who has viewed

Metadata

All the “Stuff” that tell you about a Media asset ,,,,
UMID / EIDR
Time_in
Producers_name
Program_title Program_Alt_Title
Lens_type
Aspect_Ratio
Programme_Map_Table
Transport_Stream_ID

• Challenge is
  To maintain it
  (Only loose it when you want to)
• Use it correctly
• Manage it efficiently
• Index using it
• Do not reinvent it
• Do not re-keyboard it
These are the challenges you will solve !!!!!

Wetzel's Three rules of IP
1. Every packet counts
2. ALL it needs is JUST best practise
3. It is complicated by all the interactions between flows etc. etc.

All I had was “Digital”

Questions??

For answers Keep on Learning-
look at www.smpte.org/webcasts 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

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### Basic Sector grid of the Industries

<table>
<thead>
<tr>
<th>Creative</th>
<th>Cservice</th>
<th>Tservice</th>
<th>Manuf</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Film</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large and small</td>
<td>e.g Post Soh, Salford, Pinewood, Bristol</td>
<td>SP</td>
<td>S</td>
</tr>
<tr>
<td><strong>TV</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Dig Media</strong></td>
<td></td>
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<tr>
<td><strong>Educ</strong></td>
<td>R&amp;D</td>
<td>Consult</td>
<td>“?”</td>
</tr>
<tr>
<td>Military</td>
<td>Health</td>
<td>“CCTv”</td>
<td>Industrial</td>
</tr>
<tr>
<td>Gaming</td>
<td>Events</td>
<td>......</td>
<td>“Other”</td>
</tr>
</tbody>
</table>

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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 https://www.smpte.org/sections/united-kingdom/events/bill-lovell-memorial-lecture-2017
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

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 presumption that you will grow / keep up to date
- (advert) So join SMPTE and attend its meetings/ webinars and read its Journal AND Contribute to its activities “share your knowledge”

You will move across the industries doing different jobs / roles for many employers (and clients)
- So look beyond the technology space – to the business /wider issues

Enjoy it – Engineering is fun – And Broadcasting even more so!!

From www.riseweib.com
What after Graduating????????
The “answer” to the ultimate question !!!!!!!

Experiment, Continue learning,
Try new jobs, and Set a Direction..
• Get Settled by say 28 yo
Find partner & family - things change
• Get Established by say 35 yo
So that you have consolidated your role in the industry / World
• Get Recognised by say 42 yo
“You are Halfway though your working life”
And twice as old as you are now!

Then......
Another 21 years or so to Retirement
And then
21 years or so Enjoying Retirement
( So start saving for your pension NOW! )
But after about 50 yo
............  time seems to go a lot faster!

Life can only be understood backwards;
...but it must be lived forwards

Kierkegaard

Questions??
4 Points from Peter’s Career

These are triggers to your thoughts & actions

As I slide away from being at the heart of the industries
I have felt these comments have great relevance – to all

• But you know a lot of people - Bruce Devlin Aka Mr MXF
• I did not know you have done so much ..
   & not done it all yourself but with lots of people – My brother*
• But no one thinks like you – Barbara Lange Exec Dir SMPTE
• Get Involved in voluntary work – and use it to extend your experience by experimenting . Me !!!!

* After this event - look at the lecture video and slide pack – and a video made on Ipad
https://www.smpte.org/sections/united-kingdom/events/bill-lovell-memorial-lecture-2017

THE NEXT CENTURY

... You know a lot of people...

And are known by so many people for the right reasons...
- Being helpful/ getting things done/ maintaining confidences/
  knowing a lot about a lot / being wise / working hard/
  being approachable/ apologising if (rarely) wrong/using connections
Not .... Never delivering / Name dropping / always with excuses..
Many people   - lots outside “your normal work”
  – others in “the Industry “ competitors suppliers customers
  and non techies – Production/Craft/Finance/Law/Business
And trading favours .....
.... Do a lot ..... not all yourself

A lot = (Volume*Range*1/Time)*(Planning* Resourcing* Expertise)

Often small short jobs are valuable, but much work is long projects or BAU.

.... And working on many streams at once – cross fertilisation

Showing leadership – in teams (everyone has an Appointed Role)

Or in Groups (all people are more of less equal / you have no given Authority)

Enabling monitoring to control and reporting / communicating....

Getting good colleagues / educating the Team/Group to the task

Congratulating success, learning from failure – but if monitoring – you saw it coming!!

Living with others doing things wrong/ not how you would do it....

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THE NEXT CENTURY  These are triggers to your thoughts & actions

18/03/2020

....Do a lot ..... By being Organised

What are you trying to do?

......Aims Requirements and how does it fit in the world?

How are we going to do it?

......Planning, Resourcing, Monitoring, Project Management

How do you know you’ve finished and is it was successful?

.......End of Project Review

means really learning and sharing the lessons

Not just what the “Manager” “Leader” does

Every one has to know this – and do it for your bit !

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THE NEXT CENTURY  These are triggers to your thoughts & actions

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.... No one thinks like you - ideas

- Looking at things as a whole....
  ..................And are things “Broadly similar”

- Where does it / I fit in
- Comfortable with Complexity working in real & abstracted world
- Analysis of what there is - Seeing the Connections
- Synthesis of what may be ... Making Connections work
- Having Good Memory – through connections (I know some one)
- Seeking Fundamentals -- a Radical approach

No one thinks like you - more ideas

- Be curious  why and how – what context ?
- Planning and doing “thought exercises”
  Weitzel’s “Minimum Hassle algorithm” – not minimal work
- Asking questions ....and listening and probing and analysing the answers
  then conveying my opinions advice and sharing knowledge and experience
  and the reasoning I have employed -
- Documenting every thing - Sharing ideas

“The Project manager is responsible for everything “ (almost!)
And "look for the essential detail“

- a “just do it” attitude – after some thought & being quick thinking helps! -
No one thinks like you – business

Being Business like in everything for each opportunity see what it means

• For your company/employer - how much profit, positioning in market etc.
• For the bit of the company you work for – Interesting or valuable work for your colleagues
• For the industry/ society at large -
• For your benefit - personally, intellectually, professionally or in your employment
• For your activities benefit – getting others to do your work!
• For your friends and contact benefit – gets you better known as a “nice guy” in the industry.

And Aim to enjoy yourself – Think as you do not as I do

THE NEXT CENTURY

These are triggers to your thoughts & actions

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....Volunteering

• Outside work – Church, Schools, Sports clubs etc.
  Doing different things – Finance, Governance etc. with wide range of people
• Linked with your job – Societies like SMPTE RTS and with Suppliers & Customers

Gaining experiences and make connections (e.g. arranging lectures chairing meetings) - and being able to experiment where it does not matter too much..... ...

• Inside your job - setting out what you are doing next .....    

Exploiting what you know / are good at – and aim to gain new experiences and discover more ...... A lot easier the younger you are!

Essential in todays “Gig economy”

THE NEXT CENTURY

These are triggers to your thoughts & actions
Questions??

For answers – look at [www.smpte.org/webcasts](http://www.smpte.org/webcasts)
Or come to a SMPTE meeting or read SMPTE Motion Imaging Journal
Also good sources
[https://thebroadcastknowledge.com/](https://thebroadcastknowledge.com/)
[https://www.thebroadcastbridge.com/](https://www.thebroadcastbridge.com/)

Or Contact me Peter@weitzel.com

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NaSTA Tech Awards

Cover a wide range
- Innovations/ Products
- A major programme
- Developing Facilities
- Growing Skills / Learning
Ideally “all of the above” but the balance may be very different

**Does it make better Television?**
Tech for is own sake is not wanted

There is no show reel!!
- Good layout
- Logical story telling
- Appropriate Diagrams/ photos/URL
- State requirements WHY
- Describe What and How
- Why was it a success (or not)
- What next?
  “A Hand out to sell your abilities”
Join SMPTE Free first year then $15

- Meeting others working in our industries - that what [SMPTE meetings are all about](#)
- Receiving the [Motion Imaging Journal](#) (not associate members)
  - full of the latest techniques and news from SMPTE sections around the World
- Participating the [Technology relevant webcasts](#) at no Charge
- [Access our archive](#) - Look back over SMPTEs work over the past 100 years
- Attending events, [and conferences, Courses](#) at member discount rates
  – you can easily save your subscription (and it can be offset against tax)
- Getting Preferential booking for [UK meetings](#)
- Supporting those joining our industries through the [Graduate Initiative](#)
- Taking part in [standards work](#), and directing the way our industries move
- Just being an active member of the world’s largest Members society for those working with the moving image, its audio and metadata - on any platform - Film, Television, Digital media
- And there are special awards for student papers etc. etc.

**BUT SMPTE needs you as a graduate and thus be someone changing our industries**

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**Graduates**

**Graduates need SMPTE**

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 needs 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...

.... You are SMPTE of the Future

So get involved now.....
What can you do?

Join us

SMPTE UK needs more members to represent
• the wide range of industries
• and roles
• across the UK
So we can better serve the UK

As we grow the SMPTE UK community
– and take an even greater role in the
UK "media tech" and "other" ecosystems
And in SMPTE developments world wide

Join in

• Attend meetings and activities
• Contribute to meetings etc.
• Run the SMPTE UK Business
• Mentor/Mentee Younger members
• ....... And more

Like A Conversation with SMPTE Leadership

And your company can support and sponsor
SMPTE UK activities
in kind and in cash!

www.smpte.org/uk
Look for NaSTA in the sidebar for these slides