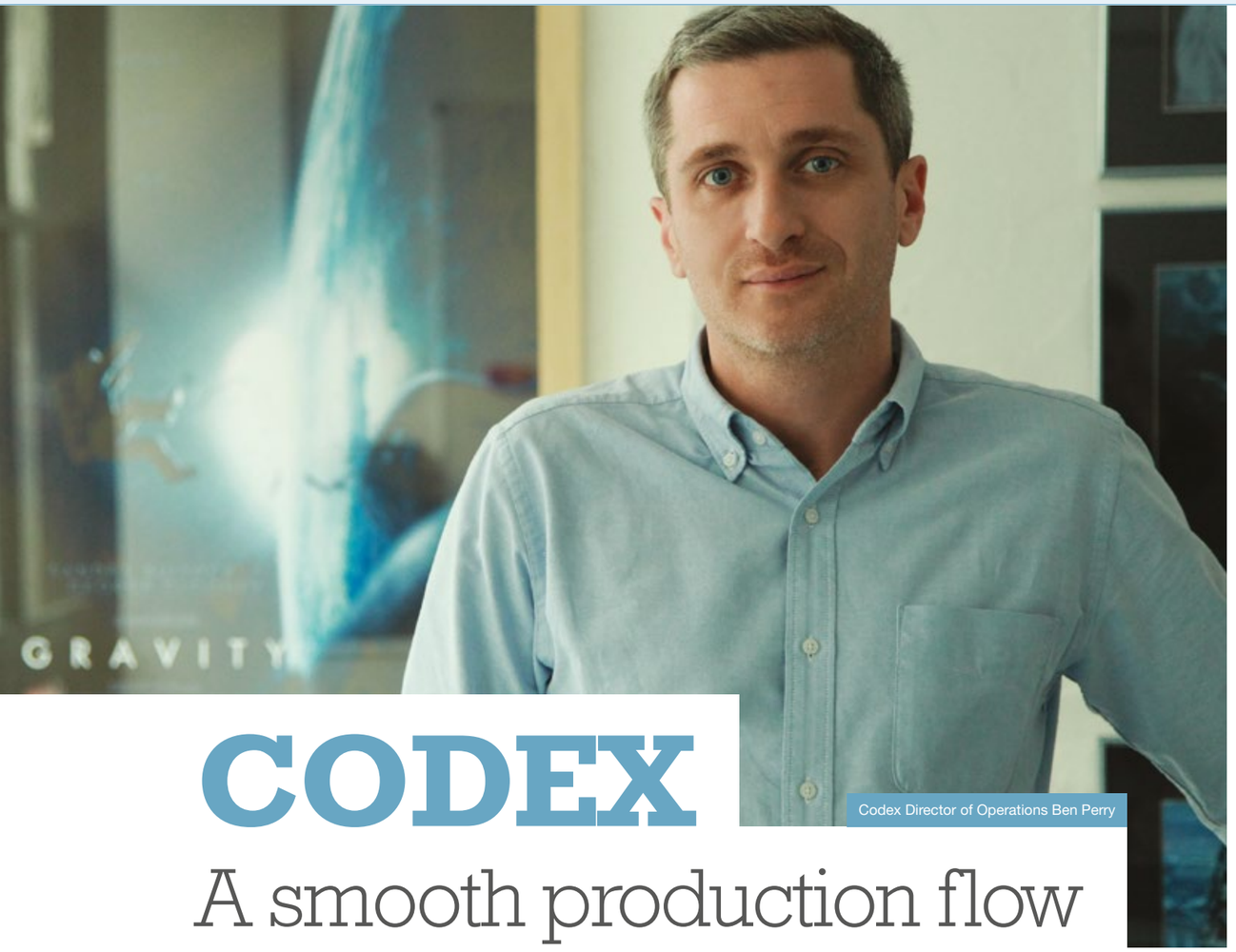

Codex Director of Operations Ben Perry

CODEX

A smooth production flow

Hundreds of press releases land in the Zerb inbox weekly and, much as we'd like to, we can't follow them all up. GTC sponsors get priority, but we endeavour to keep a 'weather eye' on all news that might interest GTC members. Last year, one name kept surfacing - Codex - manufacturers of high-end digital recording and production workflow solutions. Partnering with the likes of Panasonic, ARRI and Canon and, more out of this world, sending a 4K recorder to the International Space Station, this company and its products are clearly going places. Time to find out more, so GTC members Mark Langton and Martin Hammond were dispatched to meet Codex's Director of Operations Ben Perry.

A thoroughly British company

All Codex products are designed and manufactured in England, and much of the software development occurs at the company's London headquarters in Poland Street, Soho, where a five-storey building houses R&D, management, administration, sales and support. There is also a brand new, state-of-the-art grading theatre to assist in the evaluation of images.

The idea for Codex was hatched by Marc Dando and Delwyn Holroyd, who had previously worked together at British VFX software developer 5D Solutions, where they had experimented with data capture from the Thomson Viper FilmStream camera and identified the need for digital recording and workflow systems. Delwyn has been Codex's technical director since the business was founded in 2005. Marc became Managing Director in 2009 and, under his auspices, Codex has significantly grown its team, product range, corporate footprint and technology partners that now extend worldwide. In 2011, a US office supplying R&D, support, sales and marketing opened in Hollywood, close to many of their studio and post-production partners. Codex currently employs around 50 people between London, Los Angeles and Wellington, with additional staff, representatives and partners based in Asia, Europe and South America who support marketing and productions.

The founding ethos, which remains true today, was to design top-end equipment for the motion picture, broadcast and advertising industries, that is easy to deploy and streamlines production into post-production. The team at Codex has always liked to work closely with cameramen and cinematographers, both on specific projects, and on an ongoing basis, to ensure that they consistently come up with products that are required.

The Codex VFS

At the heart of every Codex video recorder is a custom-built software infrastructure to manage data, providing optimum quality video files regardless of the destination. This is the Codex Virtual File System (VFS). Here's how it works: when a Capture Drive with, for instance, ARRIRAW footage is loaded onto a computer, it shows up like a normal external drive. Operating underneath is the VFS. The VFS can present readily processed DPX files, MXF, DNxHD or QuickTime/ProRes proxies next to the original .ARI files on the Codex volume. Except for the recorded data on the drive, none of these additional files actually exist. It's only when these files are requested, that they are generated, 'on demand', and on the fly; hence the term 'virtual'. The file formats, file naming and directory structure presented by the VFS are fully configurable through the Codex Platform software. This makes the VFS a highly flexible tool for providing exactly the material you require, when you want it, without redundant processing and storage overhead on your drives. Ben Perry explains: "It means you've not restricted yourself to a particular file format at that point. You can take that RAW data with our transcoding engine and make any file format you need; for example, you could deliver DPX for visual effects, Avid or Final Cut files for editorial, and then add 'burn-ins' like LUTS. You can adjust metadata… but we retain a pristine 'digital negative' you can go back to."

Expanding from film into TV production

Initially, Codex technology was geared mostly towards film production and has been used on hundreds of digital features including *007 Quantum of Solace* and *007 Skyfall*; *Gravity*; *Life Of Pi*; *X-Men: Days Of Future Past*; as well as several of this year's BAFTA/Oscar hopefuls like *Birdman*, *Mr Turner*, *Selma* and *Paddington*. Increasingly, high-end TV shows are the customer, as Ben Perry confirms: "We are very much known for the feature film work, but there is a shift toward the big, episodic TV series which essentially are mini feature films: *Game of Thrones* is a great example."

Interested in how the expansion from film into TV would lead new technology moves, Mark asked Ben whether there are any plans to produce recorders capable of recording direct to ProRes or DNxHD. Ben Perry: "We have always focused on uncompressed or RAW capture for the big screen, but compressed recording is not something we say is necessarily a bad idea. Recording direct to ProRes or DNxHD is something we have looked at and continue to look at it terms of new products. We do recognise the demand for robust, efficient and cost-effective solutions for TV capture and workflow."

'Onboard-S' recorder

Pushing Ben a bit further, Mark asked what the benefits of recording RAW are over improving codecs like XAVC. Ben explains: "These are compressed formats which, depending on what you're delivering, are perfectly acceptable at the moment. Compressed formats have their place for sure, but for some... and this is being driven from the big American studios for their episodic productions... there's a need to protect the highest quality negative for the future. We have just witnessed a major TV show in the US, Marvel's *Agent Carter*, shooting everything RAW. You can shoot ProRes now, and that's fine for today's purposes, but then you've got a compressed 4K master. What happens in 10 years' time, when you want to do a redux for the new box set? TVs will have moved on, viewers might have 8K TVs and fast pipes into their homes, getting less compression on delivery. All of a sudden your ProRes masters probably won't look so good when they get upscaled.

> "The founding ethos, which remains true today, was to design top-end equipment for the motion picture, broadcast and advertising industries, that is easy to deploy and streamlines production into post-production.

There's a hike in cost to shooting RAW, but it's not that much for bigger budget productions. So they are shooting RAW and delivering what they need to now – but safe in the knowledge they have the highest quality negative already banked. They have absolute RAW files that have never been changed since they came off the camera sensor."

In another exciting venture, Codex equipment is currently recording out in space. Paired with a Canon Cinema EOS C500, the Codex recording system will be used by astronauts onboard the International Space Station to capture a set of pre-determined shots at 4K for an upcoming IMAX production, with the working title *A Perfect Planet*. After rigorous testing, including with radiation, the Codex system was chosen for its rugged reliability as well as its known good compatibility with the C500.

Working with the big players

With advances in technology, Codex has been able to design smaller and increasingly powerful products. Following its early models in 2006/07, the Codex Onboard Recorder arrived in 2011. As digital cameras gained rapid acceptance, Codex collaborated with ARRI, and the Codex Onboard Recorder

Codex key people

Marc Dando – Managing Director
Marc is well-known among cinematographic and production communities around the world. He has over 25 years experience in cutting-edge technologies, having held senior sales, marketing and management roles with Softimage, Discreet and 5D before joining Codex. Today, Marc travels the world to deepen existing collaborations and start up new technology partnerships.

Delwyn Holroyd – Technical Director
Delwyn has been developing innovative products for the broadcast television and film industries for 20 years. Prior to Codex he was a senior developer with 5D, where he was responsible for the 5D Commander, the first PC-based real-time 2K preview system. Before this, Delwyn was at Lightworks, where he was lead designer on the Newsworks product and the revolutionary, next-generation non-linear editing product known as Lightworks Touch.

Ben Perry – Director of Operations
Ben has been with Codex from the very start of the business. He is actively engaged in the day-to-day operations of the business – sales, support, marketing and administration.

Jens Rumberg – Director of Product Strategy
Jens joined Codex in 2013 following a successful 10-year spell in senior technology roles at ARRI, Germany. Prior to joining Codex he was the technical supervisor of ARRI's ALEXA XT digital cinema camera, whose pioneering in-camera recording and workflow capabilities were developed in collaboration with Codex.

Sarah Priestnall – VP Market Development
Based at Codex in Los Angeles, Sarah has over 25 years experience in production and post-production, working both for manufacturers and post facilities. She was deeply involved in Cineon software product development and managed the first digital intermediate projects, including *O Brother Where Art Thou*, while at Kodak and Cinesite.

quickly became the de facto standard for recording ARRIRAW with the ALEXA. The next step was to build recording into the camera, in the ARRI ALEXA XT, allowing for the first time uncompressed RAW capture at 120fps. The custom-made digital magazines or 'mags' contain very high-end solid state drives (SSD). The XR version can handle a data rate of 6.7 Gigabits per second, fast enough to record ARRIRAW at 120fps.

> The team at Codex has always liked to work closely with cameramen and cinematographers, both on specific projects, and on an ongoing basis, to ensure that they consistently come up with products that are required.

As well as working with ARRI thoughout their transition to digital cinema, from the D-21 to the recently announced ALEXA 65, Codex also offers workflow support for the Sony F55 and F65, and worked closely with Canon during the development of the C500, pairing it with their Onboard S external recorder to provide a reliable, high-end solution for capturing 2K RGB 4:4:4 and 4K RAW up to 120fps in the form of 10-bit Canon Cinema RAW.

To refine their products the Codex team rely on close collaboration and feedback from both engineering teams and end users. "Through knowledge of what happened with early recorders for the ALEXA, one of the weak links was found to be the BNC connection between the two units. This is why (on the later ALEXA XT) we fitted our recorder into their camera. That meant a much more secure data path," explains Ben Perry.

Codex Vault

Smaller recorders and the need to handle ever more data led to the launch of the Codex Vault – a workflow hub enabling cloning and archiving of media, the creation of dailies and other deliverables, plus playback and visual quality control from ARRI, Sony, Canon and RED cameras. It is a ruggedised unit with a flip-up touch screen, interfaces for all the different memory cards, and it's modular so you can configure it for your particular needs.

There is also a linear tape open (LTO) backup bay – currently the most secure digital storage option. For those not familiar with the format, LTO is a cartridge containing magnetic tape, originally developed for the computer industry back in the 1980s. Its current incarnation, LTO-6, is capable of storing 2.5TB of data per cartridge. There's an irony that the ultimate backup solution for digital video in this age of Flash memory, optical discs and multi-platter spinning hard drives is good ol' ferric tape!

Panasonic VariCam

At the end of 2014 it was revealed that Codex had been working with Panasonic on the development of the new VariCam 35 Dock (see pages 56–59). The launch of this camera marks Panasonic's foray into the digital cinema market. The compact recorder will capture uncompressed 4K VariCam RAW at up to 120fps. The Codex V-RAW recorder connects directly with Panasonic's VariCam 35, eliminating cabling completely to facilitate greater efficiency and higher mobility whilst shooting.

The Codex Vault system supports the rapid transfer of digital camera originals for post-production and archiving. Ben Perry explains how this collaboration came about: "They'd seen what we've provided for other big companies, like ARRI and Canon, and I think they decided they needed an absolute, no compromise recording solution. Yes, they could have gone and made it themselves but, if you're trying to launch a camera into the cinema market, it makes sense to work with people who are already active in that market. They get a Codex workflow and a lot of people understand that workflow and are already comfortable with it."

The Codex Vault: a fully integrated solution for secure copy and backup of data cards from ALEXA, C500, F55 and RED. Its modular design means it can be configured for most workflows.

ALEXA Classic with external Onboard-S recorder

Tthe Codex Action Cam with PL lens

Meanwhile, the close relationship with ARRI has matured even further, with Codex being ARRI's chosen partner to provide the in-built recording technology and Vault workflow system for the ARRI Alexa 65 camera, launched in December 2014.

Action Cam

In early 2014, Codex entered the camera market when they unveiled their Action Cam. Similar in size to the now largely obsolete Toshiba TU-series miniature cameras that once ruled the in-car/skateboard/dog-cam roost (now firmly occupied by GoPro), the Action Cam has a C-mount lens fitting that will accommodate adaptors for B4, PL and EF lenses. It boasts a dynamic range of 13.5 stops and a single 2/3" Kodak CCD sensor that doesn't suffer from skew like its CMOS competitors. Its main differentiating factor is that, while GoPros and other action cameras are great for TV production, when you try to match them with a higher-end camera like the ALEXA, F65 or F55, their limitations begin to show. Footage from Action Cam can comfortably sit alongside that from these A cameras.

Codex designed Action Cam to work with a custom-built Camera Control Recorder capable of handling two camera heads for 3D acquisition. The Action Cam fits into the RAW video workflow, making it easy to deliver rushes and archive the digital camera negative. Completely portable (the recorder can be carried in a backpack or connected to the camera head at up to 85m via BNC) and able to run autonomously from battery power, it can record 1920 x 1080 12-bit RAW video at up to 60fps. That RAW video can then be converted to a choice of delivery formats including ProRes, DNxHD via the Codex Dock or Codex Vault workflows.

Early users of the system have included Belgian DoP Stijn Van Der Veken, who used the Action Cam for a stunt sequence in the movie *Alles Voor Lena*; and Oona Menges on *Social Suicide*, a modern-day retelling of Romeo and Juliet. Radiant Images in Los Angeles have built helmet rigs and used the camera on several commercials. There are now moves to use multiple Action Cams in 360-degree rigs.

Looking into the future

While Codex products have made great strides in streamlining the transition of images and metadata from production into post-production, other challenges lie ahead. There's a need to establish secure colour pipelines, so that the look created on set is exactly what appears in the DI grading suite. There's also a need for VFX vendors to have key production and technical data to assist and speed their work. Movie and TV producers are also looking at how best to harness the 'cloud' for production and post purposes. Codex is active in all these areas, developing new solutions that will integrate with other complementary products.

Fact File

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