GEO Informatics
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Interview: 'Unlocking Data to Expanded Potentials'

Stuart Nixon, CEO and founder of Earth Resource Mapping

Earth Resource Mapping (ERM) is a well-known GI company headquartered in Australia and regional offices in the United Kingdom and America. ERM is popularly known for its 'ER Mapper' image analysis software, enhanced compression wavelet 'ECW' compression product and more recently its 'Image Web Server' product.

Stuart Nixon

We wanted to interview Stuart Nixon, President of ERM due to the fact that his company has been producing world-class products in the GI industry for a long time. He is candid, open in his responses and passionate about imaging and advancing the geo-spatial industry.

The company has successfully defended its compression wavelet technology through litigation and is currently expanding ECW sales throughout the world. At the same time, recent notable achievements have included Internet access of terabyte-sized images using ERM technologies. Jeff Thurston spoke with Stuart Nixon about numerous subjects. The following is our report.

Thurston: You started Earth Resource Mapping (ER Mapper) in 1989. At that time much of the Internet for GI applications was beginning and not fully mature. What were your thoughts at that time about where you could go with the company? How did you perceive organizations and individuals using imagery back then?

Nixon: When I first started Earth Resource Mapping, a 100MB image was a huge image (by comparison, high end digital SLR cameras now generate 100MB images for each photo). The problem was always that the pent up demand for imagery would not be addressed until imagery could be made easily available.

There was never any question that the demand was there. After all, vision is the most detailed of all our senses. Slap a map of vectors down in front of someone, and they will scratch their head and try and build a mental picture of what the map means. Add imagery to the map, and people immediately see the correlation (and also quickly spot out of date or inaccurate vector layers).

Yet images require tremendous amounts of disk space, processing and bandwidth when compared with tabular database or vector data. It would be fair to say that our entire company focus has

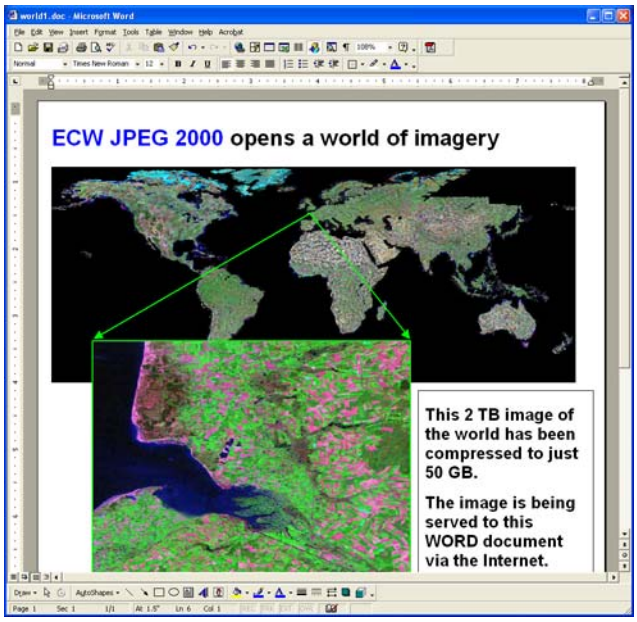
always been on making imagery more affordable and easier to use. Over the years, we solved various aspects of this problem.

Thurston: How did you solve the problem?

Nixon: ER Mapper product's key technology is its "algorithm engine" that enables complex imagery processing tasks to be performed in a single step, from input images to final output, very quickly. This has proved critical for preparation of large seamless image mosaics. It is not good enough to just mosaic and compress images. You have to apply additional processing, such as color-balancing to remove the dreaded "checkerboard" effect from airphoto mosaics.

We spent years looking at the problem of serving imagery, and finally solved this problem with a combination of two key technologies – the wavelet imagery technology used in ECW and some streaming imagery technology we invented that builds on this. The result is the ability to serve images of any size into any application, over the net.

It still amazes people when I open a WORD document, embed a URL to an ECW image on an Image Web Server – and then roam and zoom over that multi-TB image, all still within WORD.



2 TB (2,000 GB) image streamed over the Internet into WORD

Thurston: What are the challenges that remain?

Nixon: Today, the big challenge is in being able to integrate all types of information – be it imagery, database or vector data – into seamless views.

Recently, we have been putting a lot of our effort into the "integration" side of enterprise requirements. Organizations need to be able to quickly glue together integrated maps (often accessed over the web) regardless of the source. We recently released a new product called '*RightWebMap'* which is designed to address this exact problem.

For example, one of our large government clients was recently faced with a problem where they had two incompatible map servers, one serving cadastral information and one serving land information data. They needed to integrate these two sets of maps with imagery, and also with map information from other government agencies.

Using *'RightWebMap'*, the client was able to put together and launch an integrated solution within 60 days. This solution pulls together maps served using different protocols including ArcXML, Eview, OGC and ECWP into unified web based maps.

RightWebMap integrates multiple servers into seamless web maps

Thurston: Earth Resource Mapping supports open formats. Are you a member of Open GIS Consortium? Do you support the initiatives of the (OGC)? What benefits do OGC initiatives have for those people doing imagery work and what are some of the standards issues you see for imagery use currently? What isn't OGC doing that you would like to see?

Nixon: Standards – defacto or formal ones – are very important. Whenever we look at partner companies in the industry, we always consider their approach to information availability. If they lock it up, or don't support popular formats, then in my view that company does not have the client's best interests at heart.

OGC has a tricky job and I don't envy their position

Having said that, it should not be necessary to be a member of a standards group in order to use a standard. If you look at the most popular standards in common use – TIFF, JPEG, DXF, HTTP and HTML and so on, the striking feature is that you don't have to be a paying member of some standards group to use that format.

The latest version of the Image Web Server supports 4 different protocols for serving images. So the same image can be served to different users in OGC WMS, ArcXML (the ArcIMS protocol), ECWP (streaming imagery protocol) or plain HTTP JPEG images – at the same time.

Standards groups are almost by definition several years behind the "state of the art" in any given industry. For this reason, we recently decided to join OGC to provide some input and direction to the imagery side of their standards efforts.

The geospatial industry is in a rather strange position. It has a single dominant manufacturer ESRI who can decide and set their direction with little regard to the rest of the industry. OGC has to be very careful how it handles this situation. Clearly it can't and should not adopt an "anti-ESRI" approach. But OGC should also foster diversity and widespread support for standards. OGC has a tricky job and I don't envy their position.

Thurston: Assume I am a first time buyer of a product for imagery applications. How would you convince me in 10 minutes, that I really ought to look at your products? What distinguishes them from others in the marketplace?

Nixon: We offer a complete end-to-end imagery solution for enterprises. ER Mapper easily prepares and compresses imagery mosaics using smart wizards. The ECW format makes use of all those images possible in common applications. The Image Web Server quickly serves of TB size images over the Internet or secure Intranets using common protocols including WMS, ArcXML, ECWP and HTTP. Our new '*RightWebMap*' product integrates all sorts of different web map protocols and servers into unified web based maps.

Other companies offer part of the solution. ERM is here for the long haul. We look at your *complete* needs to determine what they are. Imagery is only part of the story, so integration is vital and something we are good at making happen easily.

Thurston: Earth Resource Mapping is a global company. Do imagery users use your product similarly around the world or do you find differences from country to country? Can you give examples?

Nixon: Use varies by application more than by country. The only exception to this is where a country restricts access to their imagery or GIS information. In those countries, the entire use, from government through commercial to individuals, is held back. For example, Microsoft released their MapPoint product for the USA and Europe – but not Australia. This was probably because it was difficult obtain cheap access to the Australia wide land information data (although I'm very pleased so say this situation is changing rapidly in Australia).

Thurston: Imagery files are very large. Not all users have access to broadband and high-speed connections. Does that hinder the expansion of image use and the development of applications?

Nixon: One of the features of our technology is that it works very well for narrowband connections. A user running a normal PC with a dial up modem connection in Europe can go to our (*www.EarthEtc.com*) web site (based in Australia) and roam and zoom around a 2TB (2,000GB) image over the Internet. It works quite well, by combining wavelet imagery technology with our streaming imagery ECWP protocol.

For offline use, most PC's have DVD-ROM drives now. A single DVD-ROM can store about 8GB of compressed imagery, which equates to 160GB of imagery – enough to cover entire cities in good detail.

Funnily enough, streaming wavelet imagery technology becomes more important for narrowband applications, as you can't just throw more bandwidth at the problem.

Thurston: Back in 1999 ER Mapping was involved in litigation over the issue of enhanced compression wavelets (ECW). Could you explain what resulted from that litigation and where that issue stands now?

Nixon: As SCO's recent litigation in the Linux open software market demonstrates, companies that use litigation as a way of doing business can cause a great deal of harm. *(Editor's note: SCO corporation is presently attempting to sue LINUX users internationally – more recently Novell is suing SCO over the same issue).*

In 1999 LizardTech initiated litigation against Earth Resource Mapping (ERM). The legal actions, carried out under US law, are still ongoing. This litigation has important implications for the geospatial industry - for JPEG 2000 as well as the ECW image format.

Thurston: How is this litigation going to affect the average GI user?

Nixon: It is of extreme importance to the geospatial industry.

It is worth emphasizing a report from the 22nd JPEG 2000 Working Group Meeting held in New Orleans from 4th to 8th December 2000, which said that:

> ***"LizardTech warns any future user of JPEG 2000 that if one wishes to perform a seamless DWT by any means other than holding the entire image in memory during processing, one would require a license to its patent..."***

(Editors Note: Read "Should I fear Compression Patents" in Google Group comp.compression).

Thurston: Could you explain the connection between that litigation and the impact on the geospatial industry and where Discrete Wavelet Transformation, or DWT fits in please?

Nixon: Because LizardTech's litigation has had such an impact on the geospatial market, it is worth recapping what went on over the past 5 years, and where things stand today. Firstly, let us cover the core technical issue at stake here, which is processing imagery using a form of mathematics known as Discrete Wavelet Transformation, or DWT.

DWT mathematics has been well known for 20 years or so. Wavelets allow exciting things to be done with imagery, including transmission, noise removal, compression, pattern matching and a host of image matching, classification and filter processing techniques. It is probably the single most important new way of dealing with imagery in the past two decades.

The DWT process itself is simply a way of restructuring imagery into a multi-resolution format that is sensitive to feature changes in the image. It is a reversible transformation, so an image can be transformed from normal XYZ image space into the DWT space and back into XYZ space

using the inverse DWT, with no loss of data. Of course, lossy compression techniques might throw away data, but the DWT process itself is fully reversible.

The big problem was that DWT's required the entire image to fit into main computer RAM, otherwise the speed of the DWT became thousands or even millions of times slower.

Our company - ERM - was researching wavelet imagery as part of serving technology under development, which was later released as the Image Web Server product.

During the 1990's a number of people worked out different ways to solve the problem of performing large seamless DWT operations. I received U.S. Patent # 6,201,897 which ERM uses to perform large seamless DWT operations. LizardTech licenses another patent from the University of California. Various other people such as Vishwanath, Chrysafis and others also developed and in some cases patented other large DWT techniques. One of these techniques, known as the lifting scheme, is used by JPEG 2000 to perform large DWT processing.

So being able to perform the DWT process on large images is of vital importance to JPEG 2000 and ECW as well as for a whole host of other imagery applications, and there are several different solutions to this problem.

Thurston: So it is this fact, the holding of an image in memory all at once that led to the litigation – causing the litigation?

Nixon: In my view, LizardTech litigated for anti-competitive reasons.

LizardTech litigated for anti-competitive reasons

As I noted earlier, in the 1990's ERM was researching methods to enable fast remote (web) access to imagery. This lead ERM to researching DWT as part of this solution, and ultimately resulted in patents ERM holds for inventions to do with large image DWT processing and image access over the internet.

In 1998 ERM released the ECW image compression technology as part of ER Mapper 6.0. ECW then quickly became a popular format internationally.

During the same time, LizardTech was marketing the MrSID product, based on a patent licensed from the University of California. LizardTech raised US$50M or so in venture capital funding over the years. *(Editors Note: http://seattlepi.nwsource.com/venture/layoff.asp?id=439)*

In October 1999 LizardTech sued ERM, claiming patent infringement and a host of other complaints. For example, LizardTech was upset with a technical white paper released by ERM that provided a technical comparison between ECW and MrSID.
(Editors Note: http://www.ermapper.com/application/vs_mrsid/vs_mrsid_body.htm)

As LizardTech had received a tremendous amount of venture capital funding, and was losing market share to ERM, we think that these were the driving reasons behind their lawsuit.

In October 2000, LizardTech tried to add a second amended complaint against ERM with additional claims under Seattle law as well as under US Federal law. The Court denied this motion. LizardTech then filed a second legal action against ERM, which was almost identical to the first action, and then filed a motion to try and merge the two actions. The Court refused LizardTech's motion, noting that it would have resulted in the same situation that the Court had previously denied.

Thurston: My understanding of the situation is that ERM was then granted patents for the technology and algorithms it had developed successfully – is that correct?

Nixon: In March 2001, ERM received the US patent #6,201,897 filed by Stuart Nixon in 1998. The patent covered an invention to perform DWTs on large images.

Also in 2001, ERM applied for and received a summary judgment ruling from the US federal court that ERM's technology did not infringe on the patent licensed by LizardTech.

To quote Geospatial Solutions - "The legal wrangling between Earth Resource Mapping and LizardTech came to an abrupt end in December when a federal court issued a partial summary judgment ruling that Earth Resource Mapping's Enhanced Compression Wavelet (ECW) technology does not infringe on LizardTech's MrSID (multiresolution seamless image database) patent."
(Editors Note: GeoSpatial Solutions is a popular U.S. based GI magazine)

Thurston: So at that time in 2001 the litigation ceased and ERM pursued further development?

Nixon: LizardTech appealed the summary judgement and continued litigation.

In the mean time, the ECW format continued to grow in popularity, helped by a free 500MB compressor and free decompression libraries that enabled ECW to be easily added to applications.

Thurston: What was the result of the appeal of the 2001 federal court decision?

Nixon: In 2002 LizardTech won a reversal of the summary judgment by the US federal appeals court, which sent the case back to the district court to decide.

In October 2002 LizardTech also filed a 3rd action, again essentially the same as the previous two, but this time directed against me as an individual. This was an unbelievable level of personal attack. I filed a motion asking the Court to dismiss the case and reject this remarkable step. The Court agreed and in November 2002 dismissed LizardTech's third legal action.

This left ERM defending itself against the two original actions filed by LizardTech, which had the critical patent issues resolved in ERM's favor in 2001 but then overturned by appeal in 2002.

Thurston: Therefore ERM is still involved in litigation with LizardTech? What is happening with respect to that currently?

Nixon: Quite a lot!

In July 2003, after consuming about US$50 million in venture capital funding, LizardTech was sold for US$11.25M dollars to a small Japanese public company called Celartem. Having consumed a staggering amount of venture capital funding.
(Editors Note: Celartem Acquires LizardTech)

In October 2003, I along with other inventors at Earth Resource Mapping received US Patent #6,633,688. This invention deals with Internet delivery of large images. With the two patents secure, ERM was able to pursue plans to release the full source code for the ECW JPEG 2000 library. The JPEG 2000 addition to the ECW library had been developed drawing on ERM's experience in developing large image wavelet compression technology, so the ECW JPEG 2000 is well suited to handling very large geospatial images.

In the mean time, the US Federal Judge presiding over LizardTech's action against ERM appointed a "Special Master" to the court. A Special Master is someone who acts on behalf of the Court, with expert technical and legal knowledge. By having issues examined through the eyes of a Special Master, the Court can ensure that proceedings and matters such as summary judgments are detailed, complete, and accurate. This simplifies and reduces the appeal process. Both LizardTech and ERM put forward people for consideration; the Court chose a Special Master who had been recommended by LizardTech.

In late 2003 the special master completed several hundred pages of reports.

With definitions of terms completed by the special master, ERM was then able to put forward two summary motions that it did not infringe LizardTech, and one motion to invalidate part of the patent licensed by LizardTech.

Thurston: All of this legal action must have been expensive. What was the final outcome of the Special Master decision?

Nixon: Over the last 5 years, LizardTech and ERM have spent millions of dollars on these legal cases that were initiated by LizardTech back in 1999.

ERM believes that successful defense of the case is important not only for the ECW format, but for the JPEG 2000 standard and for the industry as well.

Despite ERM having and using its own DWT patents, LizardTech believed that ERM infringed on the patent licensed by LizardTech.

The Special Master appointed by the US Federal Court recommended in favor of ERM for two of ERM's three motions. We expect the Judge to hand down his final ruling in early 2004. The motions are likely to be definitive for the case.

Thurston: So where do you go from here?

Nixon: ERM is readying release of the latest version of the ECW libraries. The ECW format remains unchanged and fully compatible with previous releases. The ECW JPEG 2000 library contains four exciting additions:

- Reduced memory needs to compression even larger 50TB+ size images
- Full compression and decompression support for both JPEG 2000 and ECW
- Release of the full source code for the ECW JPEG 2000 library
- Three simple licensing models. Two are completely free. The third is royalty free.

The ECW JPEG 2000 library contains four exciting additions

LizardTech in the mean time renamed MrSID to GeoExpress, and moved to a per-MB charging scheme. Celartem, the company that now owns LizardTech, issued a report anticipating a loss of 1,150 million Yen (about US$11 million) for the 2004 fiscal year on sales of 3,300 million Yen (US$33 million).
(Editors Note: Celartem Announces Revision of Financial Forecast – January 2004)

Thurston: How does your ECW differ from JPEG2000? What are the considerations when comparing these two formats and how does that impact users?

The main thing to realize is that ECW and JPEG 2000 are both wavelet image compression formats. So they really do the same thing, it is just that the physical file format is different.

ERM is very committed to open standards. When we first released ER Mapper some 15 years ago, we published and documented the .ERS image format headers for people to use and copy.

The new ECW JPEG 2000 libraries let people read (decompress) and write (compress) *both* the ECW and the JPEG 2000 image formats.

The great thing is that the one library supports both formats, and the library function calls have remained unchanged from the earlier ECW-only library. So application developers who already support ECW can simply relink with the latest library and add full JPEG 2000 support.

Thurston: Can you describe the relationship between ECW and JPEG2000? What design considerations were involved?

Nixon: ERM is not trying to force a particular file format on users. Today, ECW is certainly far more widely used that JPEG 2000 in the geospatial market. However, the new ECW JPEG 2000 library will encourage people to swap to JPEG 2000 over time, whenever suites them.

The ECW JPEG 2000 library fully supports streaming imagery support using the Image Web Server's ECWP protocol for both ECW and JPEG 2000, and this continues to be transparent to applications (which is why you can open a 2TB image inside WORD and roam and zoom over the image being served over the Internet directly into your WORD document).

From a technical point of view, ECW and JPEG 2000 had somewhat different design emphasis, specifically:

- ECW was designed and tuned to do one thing and do it well: handle lossy compression and local or internet access to very large (TB+) size RGB or grayscale images at 95% or so compression rates (20:1). So in this sweet spot, ECW will probably always be a more efficient format, simply because that is what it is designed to do.

- JPEG 2000 (our implementation or other libraries that fully implement the JPEG 2000 format) offers other advantages, including the ability to do true lossless compression, the ability to compress 16 bit and 32 bit data, and the ability to carry more meta data within the file format itself.

- JPEG 2000's support for very large files is not as "clean" as ECW. It will be a bit slower than ECW for very large files, particularly if the encoding techniques were not optimized for large files. The ECW JPEG 2000 library was built to handle very large files, and automatically creates JPEG 2000 files structured for good large-file performance.

- ECW is a single file format, which has not changed. So it is highly compatible. ECW is available for 32 and 64 bit operating systems, and as there is only one version, there are no compatibility issues unlike LizardTech's multiple MrSID formats. When comparing ECW to JPEG 2000, the very complexity of the JPEG 2000 format is both a blessing and a curse. Very complex methods can be used to encode image. However it is likely that there will be compatibility issues between different JPEG 2000 libraries for some years to come – just as there are even today with TIFF (very few if any products can read all of the myriad of different styles of TIFF that exist).

- ECW has a unified map projection built into the format; JPEG 2000 already has at least three competing ways to store map projection information. Map projection information is of course vital for the geospatial market.

To ERM, image standards should be enabling technology, not litigative or proprietary weapons. Our track record speaks for itself.

Thurston: JPEG2000 is very interesting and offers unique possibilities for geo-referencing. My understanding is that it is an 'open' standard, that would seem to compliment your viewpoints?

Nixon: The nice thing from the industry point of view is that ERM has worked hard to make ECW and now JPEG 2000 open and widely used, and an easy to use and transparent experience.

ERM has worked hard to make ECW and now JPEG 2000 open and widely used

Given that ERM, who is a predominant driver of imagery technology in the geospatial industry, has put its weight behind JPEG 2000, we certainly look forward to JPEG 2000 becoming a mature and widely used standard within the next few years.

Thurston: What's new in ER Mapper?

The new ER Mapper V 6.4 will automatically re-project imagery on the fly if it is not in the required map projection. So ER Mapper will re-project, clip, color balance, mosaic, and compress – all on the fly without needing to write any intermediate image files out.

Because data bundles (like imagery) are getting larger and covering wider areas, "local" map projections like state planes or UTM zones end up only covering a portion of the data area.

For this reason there is a strong trend towards storing everything in a single unified map projection, typically latitude/longitude based Geodetic WGS84. The imagery is simply re-projected on the fly into whatever map projection is required at the time.

Thurston: Where are you seeing applications for the ECW Decompression SDK for Windows CE product?

One reason we are moving to open source for things like the ECW Decompression/Compression SDK is because of the tremendous interest in this technology.

For example, there are literally dozens of different Operating System/CPU combinations out there, and it is hard to try and supply binary libraries for all the possibilities. We will continue to offer binaries for popular OS's (Windows, CE, Mac, Solaris, HP, etc). Also offering source enables developers to compile and use our libraries for whatever platform they want.

The main use for the ECW libraries on CE products has been for field use. People want to be able to take high resolution imagery out into the field with them. A CE device can comfortably store enough high resolution imagery when compressed to do this.

Some of our clients are also exploring ways to connect CE devices directly into their web servers, so they get access to the full multi-TB imagery when in the field.

For example, the National Agency for Environmental Protection (APAT) Italy, has developed a WebGIS application that streams 300GB of imagery (compressed to a 15GB using the ECW format) across the Internet to handheld PCs from its Image Web Server website.

APAT employees can now zoom and roam over huge compressed ECW images from a handheld PC whilst working in remote locations. Employees connect their handheld PC to their mobile phone (wireless transmission portal) allowing for an Internet connection using Bluetooth Technology. Once connected, the ECW image is served to their handheld PC via APAT's Image Web Server website.

Thurston: Images sizes are increasing in size and terabyte servers are increasingly becoming common. Do see you organizations operating such large servers themselves or farming image storage to third party providers? What are the advantages or disadvantages of each approach? Do you think ER Mapping products affect the choice?

Nixon: Organizations will serve their own data. A terabyte of data is only 50GB when compressed at 20:1 (a typical compression rate for ECW or JPEG 2000). This is a small amount of disk storage these days. Even serving imagery for all of Europe at 1 meter resolution is only a few TB of disk storage when compressed.

Imagery for all of Europe is only a few TB of disk storage when compressed

Remember that within 5 years PC's will probably have TB disk drives as standard configuration. This means that a standard PC could store say 20TB of imagery on the desktop – enough to cover

much of Europe at 1 meter resolution. The demand for airphotos is exploding. Although the need has always been there for accurate imagery to see what is going on with land use, it has only been feasible to deliver this imagery to applications over the web for the past couple of years.

Thurston: ER Mapping using the term 'wizards' extensively. Can you explain what that term means within the context of the product? Does this mean wizards can be opened independently?

Nixon: Some years ago we realized there was a need to move imagery from photogrametry and remote sensing experts into the hands of GIS professionals.

This meant packaging up powerful processing techniques into simple operations – wizards.

Today, a user can geo-code, mosaic, color balance and compress image mosaics using a couple of ER Mapper wizards. So we are very pleased to have delivered on making imagery more usable. It is a similar process to what happened in the desk top publishing arena in the 1990's. Up till then, expert graphic artists used very expensive document publishing tools to prepare artwork. Today, everyone uses graphics layout tools and thinks nothing of it. This was the goal behind years of work in ER Mapper R&D to make imagery just another tool.

Wizards are built on top of the very powerful ER Mapper "algorithm engine." This is actually a library that is used to build ER Mapper and other applications, and it is why (for example), plugins like our free ECW plugin for ESRI products can perform full image algorithm processing.

ER Mapper wizards automate complex tasks

Thurston: What are your thoughts about a Pan-European imagery database? Are we moving toward that in your opinion? What image resolutions would be needed at a Pan-European level in your mind, for it to be useful? Do you think the EU Commission is making headway on this issue?

Nixon: Pan-European imagery databases are a great idea and I strongly endorse this idea. We are slowly moving in that direction. What is interesting is that because commercial satellite imagery remains expensive and is limited to about 1 meter resolution, airphotos are becoming the common source for large image mosaics. This trend is strongly accelerating, in turn making imagery more affordable.

The EU Commission is making some headway, but the US approach to federal information (such as imagery and GIS data) is that it should be freely available. This is critical to successful use of geospatial information like imagery.

Experience has shown time and time again that as soon as agencies start controlling and charging for data, it quickly gets bogged down in a morass of charges and infrastructure.

One point I would draw you attention to is that imagery is vital for environmental monitoring and change detection. We really should be aiming to make high-resolution (sub-meter colour) imagery available – and updated yearly. This is the best way to detect changes before they get out of hand.

Thurston: When we talk about images, there also seems to be issues of privacy. Do you think that the imaging market is currently being impacted due to privacy concerns? If so, what could be done to change that?

My views on imagery privacy are that it is not an issue. Today, one can find the address of most people just by looking in the phone book or the online yellow pages. You can drive by a house and look at it or take pictures of it. Airphotos have been taken for urban areas for decades and have been available if you knew which government department(s) held the photos. Non-commercial users have even higher resolution imagery available to them.

I don't think that privacy is an issue.

Thurston: Where do you expect your company to be in terms of products in near future? The long range? What is it going to look like and what will you be doing then?

Nixon: We are just wrapping up a major 3 year R&D cycle, with new releases for all of our products, which will all be introduced in 2004 (some like ER Mapper 6.4 have already been released).

The emphasis continues to be on ease of use, and cost effective processing, serving and use of multi-terabyte images.

Thurston: In Europe there is growing discussion about 'open source.' Do you think we are going to see a backlash against proprietary products in the GI marketplace? What do you perceive to be the issues driving this debate?

Nixon: Open source is great, and I certainly hope that organizations like SCO and LizardTech don't damage this too much with their litigious approach to business.

We are releasing more and more of our own technology as open source, with the new ECW JPEG 2000 SDK library being one example of this.

A huge battle in the next 5 years between Microsoft and the Open Source industry

My feeling is that we are possibly looking at a sea change on the desktop. It would not surprise me if Linux becomes popular on the desktop with 10 years. It has been reported that IBM is planning to move their entire organization over to Linux on the desktop, which would be a natural precursor to assisting their large enterprise clients to do the same.

One major problem today is litigation associated with patents. It is a primary reason why companies like IBM assemble large portfolios of patents, simply to protect themselves. It is why ERM also applied for and received patents for some of our imagery technology – it enables us to release the technology as open source and protect the user community from litigation sharks.

My feeling is that we are going to see a huge battle in the next 5 years between Microsoft and the Open Source industry.

Thurston: Small business drives economy. Image applications are not inexpensive to develop nor distribute. How can a 3-4 person small business get into the imaging marketplace effectively - what is your company doing to support smaller players?

Earth Resource Mapping has always been "small company friendly." If you look at our resellers around the world, probably 2/3rds of the 300 or so resellers would be defined as small companies.

What is interesting is that many of these companies grew rapidly by adding imagery to their GIS and land information solutions mix and offering specific solutions to large enterprise clients.

There is a strong demand for packaging of information – imagery, street maps, land parcels, whatever – into easy to use data bundles. This is an area that small companies could do very well in.