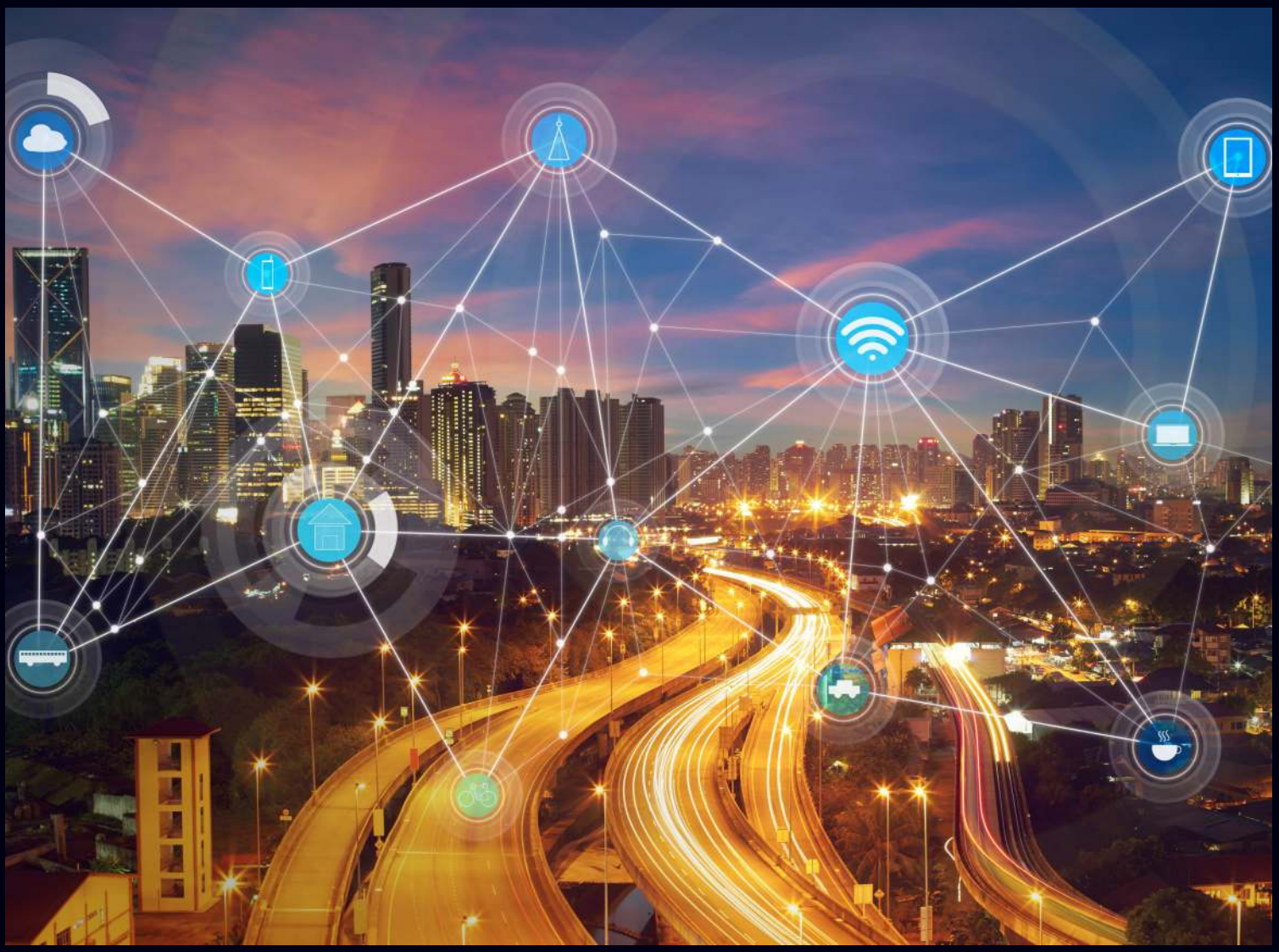
ISSN 2056-6735 (Online)

The Crucible

The Internet of Things

In Conversation with Nick French

Selenium and the Birth of TV



THE MMTA'S INTERNATIONAL MINOR METALS CONFERENCE 2017

TAKING PLACE AT THE CONRAD HOTEL, DUBLIN, IRELAND, 24-26 APRIL 2017

Organised by Metal Events Ltd

Speakers for 2017 include:

The MMTA's Popular Science Talk: Laurence Knight, Producer, BBC World Service, and Andrea Sella, Professor of Inorganic Chemistry, University College London, will take a tour around some of the amazing minor metals elements that make up our industry. The BBC World Service has just completed its Elements programme, which took a close look at chemical elements, the basic building blocks of the universe. Where do we get them, what do we use them for and how do they fit into our economy?

"Developments in aero-engines and material choice", by **Bill Reid, Strategic Sourcing Manager: airfoil castings, forgings and mill products, Pratt & Whitney, USA**;

"Delivering a conflict-free supply chain", by **Carolyn Duran, Director, Global Supply Management, Intel Corp, USA;**

"An update on specialty and stainless markets", by **Markus Moll, Managing Director, SMR GmbH, Austria;**

"Coatings for gas turbine blades", by **Dr Lisa O'Donoghue, University of Limerick, Ireland;**

"Tomtor — an alternative source of supply for scandium and niobium", by **Alexander Malakh, Chairman of the Board, TriArc Mining Ltd;**

"Energy storage and its applications", by **Professor Peter Hall, Chair in Chemical Engineering, The University of Sheffield, UK;**

"Lithium and cobalt supply requirements for batteries", by **Simon Moores, Managing Director, Benchmark Minerals Ltd, UK;**

"Future applications for minor metals: Bi, In, Se, Ge & Ga", by **Dominic Boyle, PPM Pure Metals GmbH, Germany;**

Be sure to take advantage of the current excellent early-bird rates:

MMTA Members will pay the exceptional rate of £700 (+ VAT where applicable) for all registrations received by 11th January 2017

The current fee for Non-Members is **£950** (+ VAT where applicable) for all registrations received by 11th January 2017

To find out more, contact gina@mmta.co.uk or to register for the conference please visit www.metalevents.com or www.mmta.co.uk/conference, or alternatively email sales@metalevents.com

MMTA Conference Golf Tournament, hosted by ICD Alloys & Metals LLC

For our first golf tournament, taking place on **Monday 24th April** before the start of the conference, we will be at **the prestigious K Club, previous venue of the Ryder Cup**.

The tournament fee of EUR150 (+ VAT where applicable) will include transport by coach from and back to the conference hotel, breakfast on arrival, 18 holes of golf, electric buggy, and lunch

Registered conference delegates wishing to join this event, should contact admin@mmta.co.uk

NEW MMTA MEMBER COMPANIES

Ireland Alloys
PROCESSORS OF COMPLEX ALLOYS

Founded in 1964, Ireland Alloys Limited specialises in buying, processing and selling complex alloys as well as providing services and solutions to all of your revert management and secure disposal problems.

Buying or selling, Ireland Alloys brings the same honesty, integrity and fairness to its commercial activities. Over 50 years we have made and retained a lot of friends in the industry we serve by constantly meeting and surpassing their needs.

WHAT YOU GET WITH IRELAND ALLOYS

- Approved suppliers of titanium and superalloy solids and turnings to the world-wide vacuum melting industry.
- Approved to carry out the secure disposal of time-expired critical parts by aero-engine manufacturers and overhaulers.
- Suppliers of selected and graded recycled scrap for direct melting, in the form of individual alloys or tailor-made blends, providing a cost effective alternative to virgin raw materials
- Technically innovative processors with access to the most critical markets allowing our supplier partners to optimise the returns on their materials
- Quality approved to ISO 9001.2000 with fully auditable systems

Contact: Iain Hogg **Email**: lain.Hogg@ireland-alloys.co.uk

Website: www.ireland-alloys.co.uk

EUROMET sa

Euromet is a trading company for non-ferrous metals, bulk ferro-alloys, noble alloys and pig-iron. Euromet is present in all main European markets, middle east and USA; the mission is customer's satisfaction through commercial, logistic and financial services. We offer readily available materials, on time delivery and flexibility.

Contact: Massimiliano Gentile **Email**: gentile@eurometsa.com

Website: www.eurometsa.com

USE THE MMTA OFFICE MEETING ROOM FOR FREE*!

***BENEFIT OF MMTA MEMBERSHIP**

CENTRAL LONDON LOCATION

Contact the MMTA at admin@mmta.co.uk to book the meeting room.

INSIDE THIS ISSUE

The MMTA promotes essential elements that add quality, safety and enjoyment to our lives.

The MMTA is the world's leading minor metals industry organisation.

mmta
Minor Metals trade Association

Contact Us:

Address: MMTA, Suite 53, 3 Whitehall Court, London, SW1A 2EL, UK

Tel: +44 (0)207 833 0237

Email: executive@mmta.co.uk

Letter from North America

Dear Members

By the time you read this letter, we will have a new president here in the U.S. However, as I write it this bright, crisp, afternoon here in Manhattan, it is anybody's guess who it will be. Even at 0615 hrs this morning, when I arrived at my local polling station, I had to wait some 35 minutes before I could fill in with black ballpoint pen the requisite ovals on my voting form. After I'd shoved it into the counting machine (by which it was swallowed up), I declined a round sticker indicating that I had voted.

Steve Conlin, Gina Evangelidis, Noah Lehrman and Vincent Bocchimuzzo all seemingly optimistic with the outlook for global metals

Guests at the MMTA's Global Metals Outlook event at HSBC's offices in New York.

This whole election can only really be described as having been a cringe-inducing embarrassment. When we asked a friend of ours (newly arrived in NY from Sydney), what she and her friends thought about the whole thing in Australia, the answer was: "A joke!" Would that it had been. Sadly, it was neither a joke, nor was it funny. I believe that, whoever wins, the spectacle to which we have all been subjected has, potentially, done this country irreparable reputational damage.

In a couple of my letters over the summer, I took a look at what the two leading presidential candidates thought about trade and, in particular, both the Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TIPP) with the EU. Neither, as you will recall, had much positive to say about TPP. Both have stuck to their guns right up to the bitter end. So, it remains to be seen what the winner will actually do. And, if he does win, whether Donald Trump will impose punitive tariffs on Mexico and China, and renegotiate NAFTA!

On to more pleasant things. It was great to see Gina Evangelidis of the MMTA here last month when Ed Meir of INTL FC Stone Inc. gave his metals outlook at HSBC's offices on Fifth Avenue. I certainly went away considerably the wiser from his assessment of the global outlook for aluminium, copper, zinc, and nickel. Since the situation has been somewhat unclear for a while, I found particularly interesting the light he was able to shed on what is happening in the nickel industry in the Philippines (and Myanmar).

Finally, as is my wont, I continue to scan the news for interesting scientific advances involving minor metals. Since I have always been interested in superconductivity, I was especially interested to read about the results of some research being undertaken at the University of Houston, Texas. Researchers there have demonstrated a new method for inducing superconductivity in non-superconducting materials. And have, thereby, proved a concept that has been around for decades.

They were able to demonstrate that superconductivity in the well-known non-superconducting compound $CaFe_2As_2$ (calcium iron arsenide) can be induced at high critical temperatures by antiferromagnetic/metallic layer stacking. Since superconductivity usually involves cooling, which is expensive, Paul C.W. Chu, chief scientist at the Texas Center for Superconductivity at the University of Houston said that "the method used to prove the concept offers a new direction in the search for more efficient, less expensive superconducting materials."* That would be exciting.

Not really wanting to know the election result, but wishing you all the best from a pre-result New York, I remain

Yours

Tom Butcher © November 8th, 2016

* Phys.org: *Physicists induce superconductivity in non-superconducting materials*, http://phys.org/news/2016-10-physicists-superconductivity-non-superconducting-materials.html

ADVANCED ALLOY

SERVICES LIMITED

We focus on quality

Established over 21 years with an unrivalled reputation for supplying pure metals and high temperature super alloys into the aerospace, oil, medical and associated industries

Accredited ISO 9001, ISO 14001, BS OHSAS 18001

We buy & sell

Specialists in the supply of

- Mo
- W
- Nb
- Ta
- Hf
- All Nickel / Cobalt based alloys

Full revert management/processing

- Shot blast
- Size reduction/plasma
- Bar cutting
- Turnings degreased

Suppliers of High Temp Raw Materials & Pure Metals

Call us on **01909 569930**
Email us at **info@advancedalloys.co.uk**
Website **www.advancedalloys.co.uk**

CCAS UKAS mmta Minor Metals Trade Association

Lunch and Tea with the MMTA

My second candidate for Tea with the MMTA, Nick French, arrives – dare I say it – looking remarkably relaxed. It is not six months since this metal merchant with a voice like a BBC newsreader gracefully left the cobalt stage, retiring from the company, SFP Metals UK Ltd., he founded in 1999.

In an elegant, but well-worn, blue suit, and open-top, Nick can still boast a full head of hair, even if fair has now faded to white. However, there is still much of the blue-eyed boy who was first employed by Colin Williams' Wogen Resources in 1976 in the heady days when a trader was a trader and a broken cathode was a broken cathode.

With Nick now a free man, what better time to reflect on a working life at the heart of one of the MMTA's major minor metals markets? (The 'major-minor' phrase was first coined by Peter Robbins of Wogen in the 1970s when the rather short list of minor metals at the MMTA's inception in 1973 consisted of antimony, magnesium, nickel, cadmium, bismuth, selenium and mercury.)

The first procedural problem is that, due to an earlier meeting, morning tea has already segued into lunch, so it is agreed that we adjourn to *The Mute Swan*, conveniently placed three doors down from the office. By this stage Nick is keen to ask what are the terms of reference and aim of this interview, modestly suggesting he is not a worthy subject. I try to explain that I feel proud of the way the MMTA has developed in the last few years and how our parish magazine, *The Crucible*, has become an unique organ amongst metal trade magazines – a vessel for the full array of issues relating to our trade, the comings and goings of people, the folklore, the science, the announcements and notices, and many small matters that bind a group of people linked to a common trade.

It is not long before Nick further proves the point about community by recalling how our longest serving MMTA Chairman, Howard Masters, and he, had bonded over sport (in his case rugby, for which Nick has a Cambridge Rugby Blue) and cricket (in which Howard is a member of the MCC), and how welcome Nick had been made to feel in his salad days all those years ago. He tells me that at this year's MMTA Anniversary Dinner, he has been invited to Howard's *oldies table* which will also be his 64th Birthday and a fitting bookend to this major minor metal trader's minor metal career.

But what, I ask, does he take from a life in metal, and was there another path he might have taken? As with most of us, he says, metal was not a trade on the radar of the average careers tutor in the 1970s. No one said 'Have you heard about the metal trade? I think you should get into it.'

Born in Paris in 1952, Nick lived there until the age of four when his shipbroking father took the family to Lausanne and finally (where else?) Reigate. Father hit hard times and Nick went to a direct grant school – Haberdashers' Aske's. Gaining straight A's, his father had wanted him to go out to work, but it was his mother who argued for her son to go to Cambridge.

After University, Nick's first job on the outer edges of the commodities universe was as an account executive at U.S. commission house EF Hutton who promptly posted him – to Paris. It was there that he shared a flat with a fellow Cantabrigian, Sam Blyth, who was busy attending the then strike-bound Sorbonne. While Nick was out marketing cocoa, coffee and sugar by day, Sam was exploring the other goals that Paris life could provide. In those days too - then, as now - Paris came alive with Rugby in the winter, and it was this that happened to draw Sam Blyth's cousin, the pipe-smoking and laconic Colin Williams, over the Channel. It was on one such visit, that Nick found himself answering questions about what he did for a living and explaining to Colin with great seriousness what commodity trading was about, rather unaware that his answers were being addressed to someone not entirely unestablished in the business. This proved to be Nick's interview; and, upon returning to London, he was invited to the offices of Wogen in Devonshire Street and offered the job that would mould or, shall we say, cast, his metal life.

For a home counties boy, metals opened a whole new world, a world of merchant adventuring (as Colin Williams would describe it) one which could find you visiting countries as far flung as pre-liberalised China, Cold War Russia and a varied smattering of Eastern and Central European satellite states. Equipped with a metal shopping list, an absence of a credit limit, and the confidence of youth, French describes the excitement of obtaining resources and selling into the market. As Nick says, 'It felt like a kind of fantastic sport'. Metal aside, the mix of characters in the world of trade spilled as if from a fantastic novel containing minor Spanish counts, semi re-conditioned post-war Germans who had served on the Eastern Front, Politburo KGB apparatchiks and Jewish traders

who had emerged from the European maelstrom into an international trading network that encompassed East and West. It was, Nick noted, a trade that took all sorts.

But, to take a metal term, there is a kind of hallmark to a notable metal career, and, in Nick's case, the one imprinted like a stick of Brighton rock states 'Cobalt 99.9%'. Still perhaps the most political of the minor metals, in those days it was a state-run business associated mostly with Zambia and Zaire (Congo) – before Nickel by-product tonnages drew attention away from Africa. By his involvement in cobalt, Nick was witness to the way geopolitics could influence price - such moments as the invasion of Katanga Province in the 1970s, when such an event had the power to move the world market for this high temperature metal that was just maturing in its applications in the new jet age for turbines in the expansion of air travel. Cobalt hit $50 per lb in 1978.

Heady times for sure, excitement, adrenalin, macho games, which many of us have had the chance to experience in our youthful business life; and when what we think of most is the game and the risk. But, as we get older, I ask him, to what extent do we look back and reflect on the moral complexities of trade?

As we walk back up the road from lunch, we touch on some of the moral issues of the trade.

But before going any further, I notice it is almost 4.00 pm, and I recall, from working alongside Nick at Wogen, it is the moment in the afternoon when Nick would customarily request a nice strong cup of tea and an aspirin. This afternoon he courteously declines the aspirin.

I continue, gently, that there are events in relation to African purchases and sales of cobalt - certain smoke and mirrors - that do not add lustre to the cobalt market in relation to Africa, and ask if he sees any room for optimism? This leads to a discussion about the issues that we know to be endemic - levels of corruption, state-owned companies that did not pay their workers, the legacy of the end of colonialism, the lack of investment by the newly independent African nations, and today's privatisations that can lead to transfer pricing, with costs so easily retained in the country of production, and profit all too easily re-patriated abroad.

I say to him that, when I was first into the trade, I was just rather proud to be a trader. Trading, it seemed to me, in my youth, was a known good. It allowed nations of different political systems to communicate with each other, it brought wealth and jobs.

But today, I am not so sure. I am not sure the jobs are as good as they could be, and I am not sure our system is superior to the process for Empire building based on trade that was epitomised by the ambition of Cecil Rhodes. Nick is not more optimistic. Over the years, like many who worked with Zambia in particular, he gained a true affection for the country and its people. However, because of what he calls 'vested interests', he worries - as much as I do - for the future.

Perhaps this brings us neatly to a subject that links cobalt to a subject about which we are both of like mind - that is our wish for Zambia to do well and Congo to do better. In Zambia a new President was elected only a few weeks ago and, almost uniquely amongst African nations, without bloodshed. We have discussed how hard it is for the wolf to change its clothing. The more aggressive of our breed, those removing resources from Africa, seek only profit where it may be found. Is there any means to make relations more equitable? Could a blunt 'tonnage tax' redress the balance as regards lack of tax collected by African states on metals activities? Even as I mention this, I can hear the gnashing of teeth from a metal community countering that, with such a tax, competitiveness will be reduced and business will move to nations without this barrier. But, I am not so sure. My greatest hope, which I put to Nick, is that the growing population of young well educated graduates coming out of University in Zambia may be ready to take on the challenge. In 1964, at Independence there was only a handful of graduates in the country, today not only is education more widespread but the benefits of the internet mean access to information, once generally held only at state level, is accessible to all. Surely in this there must be hope? It is a moment to reflect on change and in this spirit, Nick agrees to accompany me to Zambia next year on my usual trip to Mufulira where the MMTA does work and has links which are trying to make a positive contribution to a country from which we in the metals world have all benefited. Asking him about his most lasting achievement – the answer is a surprise – the many young people who came to learn and develop with SFP and whom he set on their way. It is a fitting end to our interview.

Anthony Lipmann, Lipmann Walton & Co Ltd

MMTA EVENTS FOR YOUR DIARY

MMTA Christmas Lunch, 15th December, London

This year's event at Ironmongers' Hall will begin with networking drinks and carols, and is followed by a festive 4-course lunch including wine. It will be - as always - a great way to end the year with industry colleagues and friends.

To book, visit www.mmta.co.uk or contact admin@mmta.co.uk

MMTA New York Dinner, 19th January, 2017, New York

This year we will be returning to the Cornell Club for networking drinks & canapes, followed by a topical speaker and a 3-course meal.

To register your interest in either of these events, please contact admin@mmta.co.uk

Selenium and the Birth of TV

Adapted from Teletronic, the television history site

The conditions for the birth of television can be traced back to 1817, when the Swedish scientist Berzelius discovered selenium, a metalloid in the oxygen group with electrical properties. Then, in 1873, a telegraph operator in the West of Ireland, accidentally discovered that some selenium rods, which were used as resistances, altered in value under the influence of strong sunlight. The discovery of the photosensitive properties of selenium led to the possibility of converting light waves into electrical impulses and was communicated to the Society of Telegraph Engineers, creating widespread interest. It was not long before selenium "cells" were constructed by Bell, Siemens and others.

Despite many attempts and suggestions for transmitting moving pictures before the end of the nineteenth Century, difficulties in amplifying the impulses had halted progress. Nevertheless, many predicted that it would soon be possible to obtain vision over an ordinary telephone line.

Paul Nipkov's disc scanner made use of the selenium cell, but it appeared that selenium was unable to respond to the enormous signalling requirement. The whole idea of television was to transmit images with such rapidity that they appeared instantaneous to the eye, with movements as smooth and natural as that seen on a cinema screen, and selenium seemed unable to achieve this.

Selenium had not been the only means of turning light into electricity available to the earlier television experimenters, for in 1888 Hertz and Hallwach made discoveries which led to the construction of photo-electric cells. These new cells seemed at first to offer an alternative to the slowness of selenium as they were capable of being instantaneous in their action. However, the photoelectric cells proved insufficiently sensitive and would not respond to the small amount of light available: even massively illuminated, a human face simply did not reflect back enough light.

Solving what seemed like a simple problem in theory had proved insurmountable in practise, and by the time John Logie Baird decided to begin experimenting with it, almost fifty years had passed with no real progress being made, despite much effort from researchers of all nationalities.

Using an assortment of second-hand equipment, Logie Baird assembled crude television apparatus, described in Ronald F. Tiltman's book as follows: "An old tea chest, purchased for a few pennies formed the base that carried a motor, which rotated the exploring disc, while an empty biscuit box housed the projection lamp. Scanning discs were cut out of cardboard, and the mountings consisted of darning needles and old scrap timber. The necessary lenses on the optical side of the apparatus were procured from bicycle shops at a cost of four pence each, while electric motors ready for the scrap-heap were pressed into service on duties for which they were never intended. At the time there were a great deal of ex-Government wirelesses available for a very minimal cost, and Baird bought scraps of these for his own use, adapting them to his needs. One or two old hat boxes were also utilised, and the whole conglomeration of bits and pieces was precariously held together with glue, sealing wax and odd lengths of string. These early experiments also demanded a high use of electricity and this was supplied by accumulators, (storage batteries similar to those used in motor vehicles), for lighting."

Baird realised that despite the theoretical simplicity of the task, the task of creating a practical solution had eluded many. The main difficulty lay in the light sensitive cell and therefore he concentrated

Image source: *https://en.wikipedia.org/wiki/Mechanical_television*

all his efforts on that part of the system.

In this he enlisted help from Victor Mills, a schoolboy at the time. Baird had read reports of a sophisticated wireless set built by a schoolboy at Hastings Grammar School, and went to the boy's home to meet him. Called to the door by his mother, Victor Mills encountered Baird for the first time with the inventor telling him about his work on television. "What's television?" enquired young Victor. "Seeing by wireless," replied Baird. "You probably know something about resonance. I'm getting a picture but can't do anything with it. I'm getting too much noise." Mills claimed that he soon discovered the cause of Baird's problem was that his selenium cells were too big. Mills also claims that on his second trip to Baird's makeshift laboratory he took some of his own radio equipment with him. Whilst making adjustments, Mills put his hand in front of the illuminated apparatus. "I decided I'd got it right and just then Baird yelled out, "It's here, it's here!" And according to Mills the first pictures ever transmitted were of his hand.

Image Source: http://www.teletronic.co.uk/john_baird_2.htm

There are contradicting reports of exactly when the first image was transmitted (and of what), but by the time Baird made his first reported breakthrough in transmitting a picture, his meagre funds were completely exhausted. Realising the full necessity of getting financial assistance he demonstrated his crude results to the press. An account of his experiments appeared in the *'Kinematograph Weekly'* on 3rd April 1924. Reporter F.H. Robinson wrote that Baird had demonstrated to the writer's satisfaction that radio vision was almost "a commercial proposition." Robinson informed readers that all of the apparatus used in the experiment could be purchased for £40.00, and that, " undoubtedly wonderful possibilities are opened up by this invention."

Progress continued, but it was incredibly slow. Gradually Baird advanced from the transmission of his "shadowgraphs" and succeeded in transmitting outlines of simple objects in black and white.

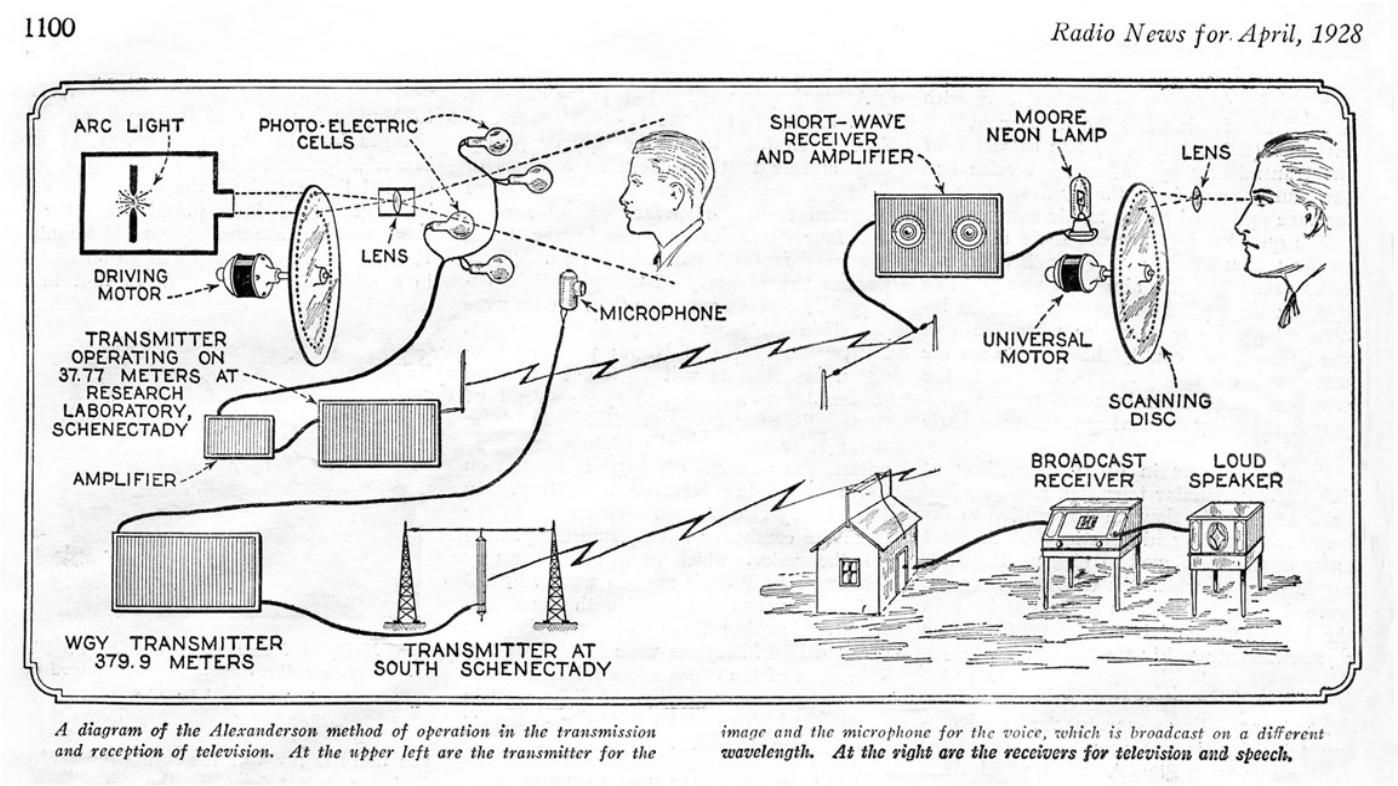
In March 1925, Mr Gordon Selfridge Junior got to hear of Baird's experiments that had resulted in the transmission of simple "shadowgraphs". He was given a demonstration and saw transmitted from one room to another a crude outline of a paper mask. Tiltman's book explains: "This was made to wink by covering the eyeholes with white paper, and it could be made to open and close its mouth by covering and uncovering the slot corresponding to the mouth opening." Selfridge was impressed enough to arrange for Baird to give personal demonstrations of the new device for three weeks at his Oxford Street store. He agreed to pay the inventor £25.00 a week and supply the necessary electrical current and material. Baird accepted this unexpected windfall without reservation and Selfridge arranged for a circular to be issued advertising the demonstration in April 1925, stating that: "our friends will be interested in something that should rank with the greatest inventions of the century. SELFRIDGE & CO., LTD".

These demonstrations were packed daily by scientists and general visitors from around the country, but those expecting to see a combination of the cabinetmaker's art and scientific equipment (as the public had come to expect from wireless receivers) were to be sadly disappointed. Instead, what their eyes beheld was a lens disc consisting of a circle cut from a cardboard box (the lenses being fixed between two layers of cardboard), whilst other parts of the apparatus showed the clear markings of a soapbox. The receiver consisted of a cardboard disc with sixteen holes arranged in two spirals. Synchronisation was obtained by using two little synchronous motors, one attached to the shaft of the transmitter and one to the shaft of the receiver, the motors being kept in step by a signal sent out from the transmitter, which was used to control the receiver.

Image Source: https://en.wikipedia.org/wiki/Mechanical_television

In spite of the publicity the inventor and his invention was receiving, his business partner grew tired of the lack of progress and told Baird that he would not invest one penny more. Baird remained convinced that he was within grasp of the vital missing link that would allow him to progress to the next stage of development. But without further funding, he found himself almost on the point of giving up. He was now living in poverty. His health again began to suffer, and in spite of trying to arouse interest in his project from the offices of several newspapers, he found that he was now being dismissed as nothing short of a crank. To save himself from starvation he had to realise a few shillings by selling vital parts of his apparatus. Finally, his work had stopped.

When his family in Scotland discovered the conditions that John Logie Baird had been living in, they responded by purchasing £500.00 worth of shares in the little known company now formed and known as Television, Ltd. Baird immediately set about remodelling his apparatus and improving its optical system. The effect of this rendered the transmitted images more sharply than



A diagram of the Alexanderson method of operation in the transmission and reception of television. At the upper left are the transmitter for the image and the microphone for the voice, which is broadcast on a different wavelength. At the right are the receivers for television and speech.

Image source: https://en.wikipedia.org/wiki/Mechanical_television

ever before but still with no detail. On the evening of 1st October 1925 Baird concluded a series of tests using the latest light-sensitive system that he had devised. The following morning, October 2nd 1925, was spent fitting the device and generally overhauling the equipment. Early on this Friday afternoon he placed "Bill" in front of the transmitter. Bill, was a rather dilapidated ventriloquist's doll that Baird had been using for many months in his experiments. Normally the dolls head came through on the receiving screen as a white blob with three black blobs marking the position of the nose and eyes. But on this occasion Bill suddenly appeared as a recognisable image, with shading and detail. The nose, eyes and eyebrows could be distinguished and the top of the head appeared rounded. In his autobiography, Baird described this historic occasion: "The image of the dummy's head formed itself on the screen with what appeared to be almost unbelievable clarity."

Flushed with success, Baird rushed downstairs where he came across William Taynton, a young office boy working on the floor below. Baird convinced the office boy to go upstairs and sit before the transmitter where enormous electric lamps gave out a glaring light and a great deal of heat. Baird rushed to the next room to see the results on his receiver but was dismayed to discover that it was entirely blank. No amount of adjusting the equipment would produce a picture, and a crest-fallen Baird went back to the transmitter. Under the intense heat, Taynton had moved away from the lamps and had moved out of focus. Baird explained to the boy that he must remain exactly where placed. This time Taynton's image appeared on the receiving screen.

On the 27th January 1926 nearly fifty scientists answered Baird's invitation, entering Baird's accommodation one small group at a time. Tiltman recorded: "When news reached the USA of Baird's achievement *'Radio News'*, one of the country's foremost journals, sent a commissioner to investigate. In their issue of September 1926 an article appeared that included the following paragraph:

"Mr Baird has definitely and indisputably given a demonstration of real television. It is the first time in history that this has been done in any part of the world." Furthermore, in an article on television in the *'New York Times'* of 6th March 1927, reference was made to the fact that "no one but this Scotch minister's son had ever transmitted and received a recognisable image with its graduations of light and shade."

With new capital investment, Baird's research now led to gradually improved results and as he worked towards turning his apparatus into a commercial success, he began to achieve results with the use of normal lighting.

Baird's success and growing reputation caused his contemporaries to redouble their efforts. In April 1927 the American Telephone and Telegraph Company staged the first television demonstration over any distance outside of England. Images were sent by wire for a distance of 200 miles between Washington and New York. The demonstration was staged amid great publicity and relied on about 1000 engineers. Baird made no comment on the American test but the following month he arranged his own demonstration when pictures were transmitted over the 438 miles of telephone line between London and Glasgow.

Adapted by **Maria Cox,** MMTA

Sources:
http://www.teletronic.co.uk/john_baird_3.htm
BFI Screenonline Seeing By Wireless, Elen, Richard G. http://www.screenonline.org.uk/tv/technology/technology1.html
https://en.wikipedia.org/wiki/Mechanical_television

MMTA's 43rd Anniversary Dinner

Alex Stewart International

We would like to take the opportunity to thank our sponsors, Alex Stewart International and RC Inspection, once again for helping to make the MMTA's 43rd Anniversary Dinner a great success.

Thanks to the generosity of our guests, we were able to raise £3,413.50 to fund three medical electives in Mufulira, Zambia in 2017

See you all again next year!

RC INSPECTION

A simple and innovative way to treat industrial effluents from the production of Alumina

Red mud field at the French alumina producer Alteo, Gardanne, France

Due to the growing level of environmental awareness in the last few decades, legislation about industrial waste disposal has become more and more exigent about the environmental impact and the quantity of final waste produced. However, for companies that generate large amounts of industrial residues, the real challenge is to manage the correct disposal of their waste. Disposing of the waste in expensive hazardous waste storage sites is sometimes the only short-term option, but the high costs that this solution implies are not sustainable. In addition, landfilling often competes with other land use options and the space in dedicated waste storage cannot be extended infinitely. Aware of this problem, two former employees of the French Atomic Energy Council (CEA) decided to found the company Extracthive in 2015. With the know-how in waste treatment using hydrometallurgical processes, Extracthive offers innovative ways to valorise industrial residues through the extraction of valuable metals, and ultimately neutralize the final waste for an optimal, low cost, disposal.

An example of the innovative approach that Extracthive can propose is the successful partnership with the French alumina producer, Alteo. Alteo used to discharge red mud, the final residue of the Bayer process, directly into the sea. In the Bayer process, strip-mined bauxite is treated with hot caustic soda, which selectively extracts aluminium from a range of other mineralised metals. The problem is that for every ton of alumina extracted, more than a ton of red mud is produced. The huge amounts of red mud disposed into the sea slowly changed the marine environment of the region. Since 2015, Alteo has implemented two filtration steps at the end of the process in order to separate the solid fraction of the red mud, so called Bauxaline®, from the liquid part, which is still released to the sea. Despite these efforts, the final effluent still has a high alkalinity (pH > 12) and a high concentration of heavy metals, both above the limits set by French environmental regulations. The French administration thus gave the company until 2021 to find a solution to enhance the quality of its waste water.

Extracthive thus proposed a bio-inspired process to obtain a neutral metal-free effluent. According to the designer of the process, Quentin Ricoux, "the idea is to reproduce the chemical reaction that happens when the effluent comes into contact with seawater". The process uses magnesium chloride to precipitate aluminates, producing hydrotalcites. The formation of hydrotalcites extract aluminum from the effluent and reduces its alkalinity. The high affinity of hydrotalcites to oxy-anions also allows the extraction of heavy metals such as arsenates, chromates and vanadates. The reaction is detailed as follows:

$$2[Al(OH)_4]^-_{(aq)} + 8OH^-_{(aq)} + 6Mg^{2+} + CO_3^{2-}{}_{(aq)} \rightarrow Mg_6Al_2(CO_3)(OH)_{16}.4H_2O_{(s)}.$$

Hydrotalcite is separated using a flocculation-decantation step, and is further centrifuged to increase the solid content of the final mud to 12%. After a successful development at labscale, this process was tested in pilot scale in September 2016, treating 1 m³ per day of

Quentin Ricoux, process engineer at Extracthive, installing the pilot scale process at Alteo

effluent resulting from red mud filtration. Chemical analysis of the effluent after treatment shows a reduction of 99% of the aluminium content and 85% of the arsenic content. The pH was reduced to 9, thanks to the extraction of aluminates. Both the pH and the residual metal content are acceptable, according to French environmental regulations.

After achieving this promising result, the efforts are now in finding a market for the valorisation of the hydrotalcite extracted from the effluent. For that, Extracthive is working on a process to extract heavy metals trapped in the crystal matrix. Hydrotalcite is commonly used as a stabilizer for Polyvinyl chloride (PVC) as it can adsorb the chlorides generated during the thermal degradation of PVC. Other applications also include the use of Hydrotalcite as catalysts.

In order to seal the partnership with Alteo, Extracthive is also working on the valorisation of the filtered red mud. This mud is mainly composed by hematite, representing approximately 50% in mass of the total composition. The goal of Extracthive is to develop a process to recover electrolytic iron from hematite, which has a high value in the market. The innovative process is based on ancient methods to extract iron using electrowinning, but with a novel design of the electrolytic cell that simplifies the extraction from the highly alkaline red mud. The first laboratory tests have shown encouraging results, where pure iron could be extracted from red mud residue. This process is the subject of a doctoral thesis at Extracthive, in which the process is expected to develop up to pilot scale in a couple of years. If successful, this process can be expanded for the recovery of metals in other types of muds.

Iron extracted from the red mud in the first lab-scale experiments

Red mud after processing and before iron extraction

Vanessa Amaral de Oliveira, Research Engineer at Extracthive

For more information: http://www.extracthive.com/

Pilot scale of the bio-inspired process to obtain a neutral metal-free effluent developed by Extracthive

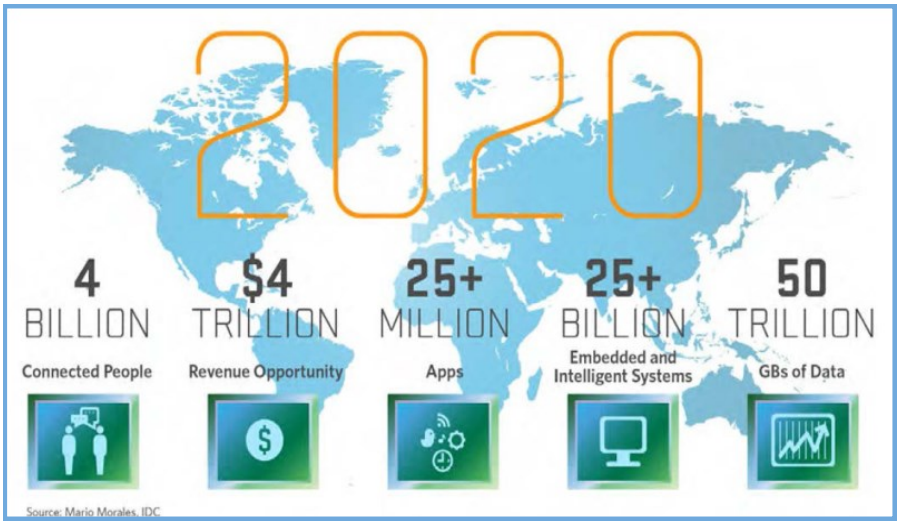
The Internet of Things: A Connected World...

James Walsh, MMTA

The internet of Things (IoT) has become a well recognised phrase over the last few years, and for good reason. It's about connecting devices over the internet and letting them talk to us, applications and each other. It's set to revolutionise the way we interact with the world around us and everything in it. For example, what if your fridge could tell you it was out of milk, or, even better, what if it could automatically order some more through an online supermarket for home delivery? The potential of the internet of things is much broader than simply making our domestic lives that little bit easier.

A year ago, no more than 15% of the population had heard of IoT, but the first connected objects date back to the mid 70's with the introduction and growth of ATMs. Now there are around 5 billion connected things and by 2020 some predict there will be as many as 20 billion. Obvious things that already form part of the IoT are smartphones and vehicles, but many other "smart devices" such as healthcare products and environmental monitoring equipment are also adding to the IoT.

But, IoT is more than just smart homes and wearable tech. The scale-up potential is huge for industry and a significant amount of data can now be collected, analysed and put to use saving companies a substantial amount of money. This could be done, for example, through tracking objects as part of a supply chain by using Radio Frequency Identification (RFID) tags, or in agriculture, monitoring crops and boosting maximum yields through a leaner use of water.



The examples are endless, and we can expect connected devices to creep into most businesses, similar to how computers and the internet have. In manufacturing, efficiency is very important and the IoT is already being utilised for organising tools, machines and people; tracking where they are and ensuring they are being utilised effectively.

A network of over 20 billion devices will create an immense amount of data, which all needs processing if businesses are to make effective use of it. The wireless communications tech industry is working on its next big development, the 5G revolution. Though 4G is still being deployed in many countries, and is adequate for now, in five or ten years time it will not be able to meet requirements for new applications. When 5G is deployed it will be 100 times faster than 4G, will have one fiftieth of the latency and be over 50 times more instantaneous in terms of getting data to and form a device. This is expected to usher in entirely new ways of doing business, create new industries and drive unprecedented economic and societal growth. Commercial deployment is expected to happen in 2020, with both industry and academia working towards this common goal.

IS IT SAFE?

The biggest challenge for IoT are the security and privacy of data floating around online. There have been high profile cases recently, including attacks on websites such as Twitter, Spotify and Facebook, where hackers used internet-connected home devices to launch a distributed denial of service (DDoS) attack, forcing them offline. These devices can also be hacked to compromise your privacy. For example, your smart meter knows when you are not at home and also what kind of technology you use when you're there.

This issue is especially important for governments and businesses where this data could be considered sensitive.

SUSTAINABILITY AND THE CIRCULAR ECONOMY

IoT technology has the potential to help us create a more sustainable world. Agriculture accounts for a high percentage of water use, especially in hot places where it doesn't rain much. Soil sensors could tell us exactly when crops needed watering. Food waste, air pollution, and more could all be mitigated by IoT technologies.

The concept of 'big data' has been around for a while but the exponential volume of terabytes and zetabytes that are being created have paved a way for a new era that is only beginning to be realised. In manufacturing, the potential data collected throughout the supply chain via IoT enabled devices could inform direct sustainability policy. IoT could potentially be great for developing a circular economy, through tracking the lifecycles of objects with embedded chips and sensors. When technologies, such as our cell phones, small appliances, and televisions become obsolete we can quickly discard and forget about them. There are huge opportunities to repurpose, reuse and create new value from these unused technologies.

MINING

The mining industry certainly haven't waited around to take advantage of developing technology and IoT connected devices and sensors. Companies like Rio Tinto employ the technology by using driverless trucks in the mining process and have also implemented mining automation systems removing operators from hazardous environments allowing them to work from control rooms.

Mining operations around the world are on this automation curve and are clearly gaining efficiencies in production, however, these initiatives are often focused and restricted within production sites. By merging data across different sites, new processes can be instigated, utilising their resources in new ways to achieve better outcomes. The number of sensors used in mines is growing rapidly and systems involved are becoming more intelligent, so the challenge is in making the best use of this data.

'SMART' ROCK BOLT

A classic example of IoT tech is a rock bolt, that are used for reinforcing mines once rmaterial has been removed, and help to distribute the immense stresses from rock mass above. What makes the new rock bolts 'smart' is a strain sensor that's been added which can monitor the 'health' of the bolt, i.e. if a bolt breaks, operators can be alerted and it can be replaced. Each bolt can talk to each other creating a mesh network and giving operators the big picture on the condition of the mine.

One of the limiting factors is the battery life of the sensor, which would be limited to a few years, but typically, if a rock bolt fails, it happens within the first couple of months of deployment.

But not only does this data need to be captured and analysed, it needs to be available in real time so that the mine's remote operating centre can modify processes, asset utilisation and maintenance to optimise production rates in relation to dynamic market demands. Through IoT, this next level of optimisation can be achieved for a single, or a group of mines, rail and ports around the world.

http://uk.businessinsider.com/internet-of-things-infrastructure-architecture-management-2016-10

https://www.ericsson.com/research-blog/internet-of-things/internet-of-things-in-mining/

https://www.australianmining.com.au/features/the-internet-of-mining-things-delivers-the-next-wave-of-productivity/

EXOTECH inc.

For Over 26 Years

Conflict Free Certified + ISO 9001

STOCKING SUPPLIER OF RECYCLED

PURE AND ALLOY

Tantalum	Niobium	Molybdenum
Tungsten	Hafnium	Zirconium
Chromium	Nickel	Cobalt
Vanadium	Indium	Other Exotics

All processing and quality assurance in house

PRODUCER OF

HIGH PURITY CHROMIUM POWDER

Purity 99.8% to 99.98% • Size -3 to -325 mesh

and

SYNTHETIC TANTALUM CONCENTRATES

SPECIALIZING IN

HIGH PURITY SPUTTER TARGET ALLOYS

RECYCLING UNIQUE TANTALUM REFINERY

Exotech, Inc.
1851 Blount Road
Pompano Beach, FL 33069

Tel: +1 (954) 917 1919
Fax: +1 (954) 917 3033
Exotech@exotech.com

www. Exotech. com

ISO 9001:2008 CERTIFIED