IEEE

Uplink

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In this issue:

From the Flight Deck

That there has been an unexpected start to 2020 is an understatement - the whole world is now focused on managing and getting through the COVID-19 pandemic!

This global challenge has impacted us all in one form or another and is forcing us to work together and reinvent many aspects of our lives, including how we work, how we learn and how we communicate.

Recently, we held our first online video-conferencing meeting of the Section Committee. This venture was a notable success, with very few bugs encountered, and we plan to continue this mode of consultation and reporting in future. By this means we will continue to provide guidance and support for our technical chapters and other subunits. Also, we are presently investigating various ways of running online technical events, with the objective of restoring at least some "normalcy" to our Section program. We will keep members fully informed on the outcome of these trials.

Several months ago, I was one of the presenters at a workshop for high school teachers on the topic of Wearable Technology, as part of the VCE Applied Computing Day. Our event was planned and run by Victorian Section Women in Engineering, and it received very positive feedback from all attending teachers. We are quite passionate about working with technology teachers, as they provide the best means of introducing technical concepts to high school students. For, a well-informed and motivated teacher has much greater influence over his/her young charges than we can ever hope to exert as "outsiders".

A room full of Technology Teachers and a table full of WIE-designed "wearables". And WIE Victoria in charge!

Returning to the present, while most of our planned events for the year (including Distinuished Lecturer visits) must remain "on hold", we will continue to communicate with members as best as we can.

Of course, we all look forward to the resumption of our normal program as soon as possible. But don't despair – professional engineers have a good track record in crises.

Please keep safe; and **positive**!

Mehrnaz Shoushtarian, PhD
Chair, IEEE Victorian Section
mehrnaz.shoushtarian@ieee.org

News & Views

An elevating experience

After weeks of frantic construction activity, the road-rail level crossing at Kooyong, Victoria, is no more. Toorak Road traffic now passes *under* an elevated section of rail track, between Kooyong and Tooronga stations. The crossing is on the Glen Waverley line of Melbourne's suburban network.

The speed with which this very substantial project was undertaken and completed has amazed long term rail-watchers, and it reflects very favorably on all personnel involved, from the professional engineers responsible for planning, detailed design and project management, to the skilled workers and supervisors on site. Not to forget the myriad suppliers of "everything"! <<<

Well done, everyone!

Toorak Road level crossing: from this …

To this - in just a few weeks! Here we see the new elevated rail tracks with the bridge over Toorak Road visible in the distance.

"In a manner of speaking…"

One of our younger IEEE members, an electronics design engineer now in her fourth year of full-time employment , has been assigned a project to recognise and identify speech sounds, even where the speaker has a speech disorder or impairment, and in randomly-noisy environments.

In her Outline Proposal for the project, subsequently approved by her employer, she writes:

The Problem: There are people with speech disorders, for example caused by strokes or injury, or intellectual impairment. It is difficult for them to call for attention if their carers are not present, or are otherwise engaged or distracted.

In industry, the growing need and use of voice-controlled robots and systems must also deal with the problem of defective speech, however caused. Safety issues arise if the machine "doesn't get it" and responds wrongly or inappropriately.

The proposed solution: a multifunction module will be developed to examine the basic characteristics of the user's voice and attempt to extract key meanings within the desired field of application, with particular attention to low quality input signals.

For health care, the device will generate a "call for carer" if this is the patients intention, or otherwise deemed appropriate.

For industry use, the device will turn on or off the controlled machine, or permit access to hazardous or security-sensitive plant or facilities, after validation of the user's authority; and again, with proper regard for corrupted and low-quality inputs.

The project will be thoroughly practical rather than research-oriented and will seek simple solutions and improvements in known areas of application. But there may also be "spin-off" uses. <<<

News & Views

Hawk-like eyes in the sky

Aeronautics giant Boeing is collaborating with the Royal Australian Air Force (RAAF) in the development of an unmanned fight er aircraft well suited to Australia's future defense requirements. Three prototypes of the new aircraft, officially known as the Airpower Teaming System (ATS) are being made by Boeing's Australian subsidiary at its Melbourne plant and trials are expected to commence later in 2020.

Although pilotless, the aircraft will not normally be sent on solo missions. Instead they will operate in conjunction with manned fighters, so extending the tactical capabilities of the latter.

Alternatively, many ATS aircraft could fly in a swarm, so overwhelming enemy attempts at electronic jamming and other countermeasures. <<<

Sharp-nosed and deadly: Boeing Australia's ATS pilotless aircraft.

A Fiery Outcome

A bushfire near Cudgewa, Victoria, burned right through this power pole and left the upper part rather pathetically suspended from the overhead cables it was meant to support. The residual smoke haze gives an idea of the intensity of the fires that ravaged this region during the summer of 2019/2020. <<<

This fire had real teeth! **PHOTO: Benjamin Gilbert**

I, Robot

Perhaps the day of the commercial robot has well and truly arrived! Our correspondent reports:

"Last week when I shopped at a Woolworths supermarket, I noticed a tall, slender, robotic figure following me around. It traversed the aisles of the supermarket, seemingly searching for visual cues. I asked the staff what it was doing, and was told that it was scanning for floor spills and breakages, and other signs of disorder, which it would duly report. Being a new supermarket, the aisles were larger than average, perhaps nearly 2 metres wide.

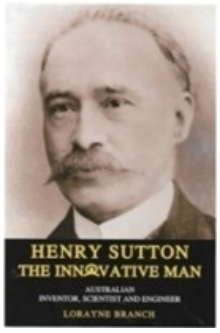
The robot moved around on wheels fitted below its heavy square base measuring about half a metre on each side. The overall height of the machine was about two metres. The vertical column contained the scanning cameras and controls. Towards the top were two rectangular windows, rather like eyes. I was tempted to spill something to test its reactions, but I resisted the temptation! It was interesting to see a robot being deployed in this manner. Industrial robots for welding, pick and place, and similar tasks have been used for many years. But this could well be the first "serious" robot application in the large-retail sector in Victoria, and possibly - in Australia. <<<

The Woolworths robot on patrol

Book Review

HENRY SUTTON, THE INNOVATIVE MAN

Lorayne Branch
(Lorayne.branch@gmail.com)



Reviewed by Anthony Gascoigne.

From its beginning, Henry Sutton's life had a touch of romance, even unreality. Born in a rough tent, precariously pitched on a prospector's mining allotment of barely 14 square metres, at Bakery Hill on the Ballarat gold-fields, he nevertheless grew up to become a major figure in Australia's scientific and technological history. That he is little known today, and that it is now necessary to re-establish his legacy, is one of the many quirks of that same history.

Henry's parents, Richard Henry and Mary Sutton, arrived in Melbourne from Manchester, England in August 1854, and shortly thereafter made their way to Ballarat, on the boggy, rut-filled road of the time. Unsurprisingly, they had little success as prospectors. All the easy surface gold had already been cleaned up, and they had to endure weather extremes, the constant threat of fire, and the many privations of life in a crowded "wild west" mining camp. Not to mention the brief but terrifying Eureka Stockade episode of December 1854!

So, being an enterprising man, Richard soon set himself up as a maker, repairer and vendor of musical instruments. This venture was indeed successful, and in due course Sutton's Music Stores became well known in Ballarat and Melbourne, a presence that lasted for well over 100 years, until late in the 20th century.

Richard's wife, Mary, presents as a strong personality and she no doubt had a strong influence on the Sutton business as well as in family life.

She tutored her young son Henry throughout his early years, and being an accomplished singer herself, also taught this art to Henry and her other children. But from the age of about eleven, the youthful Henry Sutton became almost exclusively self-taught.

And self-taught, and self-taught! As a juvenile frequenter of the Ballaarat Mechanics Institute, he had a voracious appetite for knowledge and read just about every book journal and magazine he could lay his hands on. Primarily on technical and scientific topics, but no doubt he dipped into other areas as well. And no bespectacled young swot this one – when something really took his fancy, he wanted to go home and make one, or try out the effect or phenomenon described.

Fascinated with the flight of birds and insects (who isn't!), he made himself a flapping-wing ornithopter that allegedly flew in a circular orbit under his control. Still in his mid-teens, he constructed a DC electric motor of the toroidal-armature pattern invented by the Belgian professor, Zenobe T. Gramme.

Only months after reading about Alexander Graham Bell's successful work with telephony, young Sutton had designed and constructed a cool half dozen variations on the theme – his own working tele-phones! As a result, Suttons Music became the first business in Ballarat (and plausibly, in Australia) to have its own internal telephone system. Little did Henry imagine at that stage that he would later meet the famous Dr Bell and have him as his per-sonal guest!

And so it went on: batteries and electro-chemistry, photography, optics, mineralogy, electric power, radio frequency detection, internal combustion engines, and automobiles.

Perhaps the most remarkable invention of all was his Telephane – essentially a primitive form of cable TV. An article giving a detailed description of this apparatus was published in the British journal, *Electrical Review*, in November 1890. Almost four decades later, the Scottish inventor, John Logie Baird, is said to have become aware of Sutton's ear-lier work, and it may well have been a basis for his (Baird's) successful experiments in the late 1920s. By which time there was a burgeoning electronics industry, and scientific knowledge unimaginable to a man of the Victorian era!

A.G. Bell's 1910 visit to Melbourne, and his subsequent journey to Ballarat in Sutton's company, are amply described in this book; and likewise, Sut-ton's meeting with Tesla and other notables of the day during his numerous overseas voyages, most undertaken in the latter years of his career.

And he lived long enough to witness some of the first powered flights ever made in Australia, occa-sions that reportedly gave the aging Sutton great personal pleasure!

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Derailment of XPT ST23 at Wallan, Victoria, on 20 February 2020

The Accident

On 20th February 2020, a southbound XPT interstate passenger train running on the standard gauge network derailed at the entry to a passing loop at Wallan, Victoria. There were 46 reported injuries to passengers and crew including two (2) fatalities. The train, track and adjacent infrastructure were all extensively damaged.

Running Details

XPT ST23 departed Central Station in Sydney, New South Wales, at about the scheduled departure time of 0740. The train proceeded south and arrived at Junee in southern NSW at 1452,[2] about 85 minutes behind schedule. At Junee there was a change of driver before the train continued south, arriving in Albury on the NSW-Victorian border at 1637, still about 85 minutes behind schedule. There was a change in passenger car crew at Albury.

The train departed Albury at 1644 and crossed the Victorian border. The service continued south, stopping at several stations before coming to a stand at Intermediate Home[3] signal KME28 at Kilmore East, at about 1856. This signal was at Stop, and after waiting for a north-bound V-Line train to clear the section, the driver received Proceed permission from Network Control at about 1930, but only as far as Home Departure signal KME16,[6] still within the Kilmore East operations area. As a result of earlier damage to signalling equipment, a 24 km section from Kilmore East to Donnybrook was being managed using an Alternative Safeworking System.[8] Wallan is located within this section and is about 48 rail-km from Melbourne.

At signal KME16, XPT ST23 was met by several rail workers, including a Signaller and an Accompanying Qualified Worker (AQW).[9]

The AQW boarded the leading power car and joined the driver at the head of the train, as part of the alternative safeworking system.

At about 1932, while the train was still stopped at signal KME16, the driver communicated by radio with the Network Control Officer and received Train Authority[10] for the section through to Donnybrook. The train then departed signal KME16 and entered the single-track main line towards Wallan. The line speed for the XPT in this section is 130 km/h, and the driver soon had the train at or approaching this speed limit.

One function of the AQW was to ensure that the level crossing protection[11] at Wallan–Whittlesea Road in Wallan was in place for the passage of the train.[12] (This system normally operates automatically, but now had to be controlled manually because of the signalling outage mentioned above). The onsite Level Crossing Keeper[13] later reported having received a call from the AQW, and he had duly activated the crossing protection in response.

Earlier that afternoon, the points at both ends of the Wallan Loop had been changed from their Normal (straight ahead) setting to Reverse (turnout) setting.[14] This change meant that rail traffic in either direction would now be diverted from the Main Line into the loop track (No.2 Road). Earlier that day, a Train Notice[15] (TN) had been issued reflecting this change. The TN also specified a speed limit of **15 km/h** for *entry to* the loop, and a speed limit of **35 km/h** for *exit from* the loop.

At about 1943, XPT ST23 was approaching the northern end of Wallan Loop at about the track's line speed.

Aerial view of the front part of the train after the accident. The capsized leading power car is at the right.

Recordings from the train's monitoring instruments show that an Emergency Brake application was made a short distance before the points. But this action had only a marginal effect and the train reached the points still travelling at a speed in excess of 100 km/h. The train was not able to negotiate the turnout at this speed, and all vehicles except the rear power car were derailed.

During the derailment sequence, the leading power car rolled onto its left side before skidding to a halt, and the XPT driver and the AQW sustained fatal injuries. Three passengers were seriously injured and a further 36 passengers received minor injuries.[16]

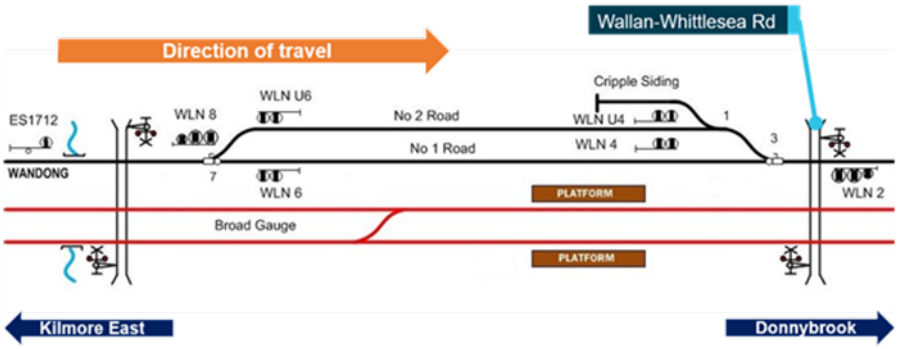
Derailment of XPT ST23 at Wallan, Victoria, on 20 February 2020 (cont'd)

Five train crew travelling in the passenger cars also sustained injuries.

Track information

The XPT service was running on the national standard-gauge track that connects Sydney and Melbourne. The track is part of the Defined Interstate Rail Network (DIRN) and is managed by the Australian Rail Track Corporation (ARTC).[17]

The standard-gauge line between Kilmore East and Donnybrook is a single track bi-directional facility that carries XPT and V/Line passenger services and also rail freight operations. There are passing lanes at Kilmore East and Donnybrook and a 1550 m crossing loop at Wallan. The northern entry to this loop is located about 1.8 km north of Wallan–Whittlesea Road (Figure 4).



The rail track layout. Standard Gauge tracks are shown in black, adjacent Broad Gauge tracks are shown in red. Source: ARTC/ATSB

Train data logger

The Hasler RT data logger is an electro-mechanical device that records speed, distance, time, a combined power-vigilance parameter, and brake cylinder pressure. These data are captured continuously on a waxed paper tape roll.

The Hasler system also includes an analogue speedometer mounted on the driver's console.

The train's speed is derived from the measurement of the rotation of the left hand wheel on the second axle of the power car. In order for this rotation to be translated into distance (and speed), an average wheel diameter is assumed. Actual speed may deviate from that recorded (and displayed) due to differences between this assumed diameter and the diameter of the actual wheel providing the feed to the Hasler system.

The Hasler tapes from the two power cars were recovered at the accident scene and examined by the ATSB. Corrections to the recorded speed were made to account for the differences between the assumed wheel diameter and the actual wheel diameter on each power car. The results from both recorders indicated a speed of about 130 km/h approaching Wallan Loop.[20] The analogue speedometer would have read slightly less than this, probably within the range 125 km/h to130 km/h.[21]

Data from recorders in both power cars indicate that there was an Emergency brake application nearing the turnout to the loop, and an associated small reduction in speed prior to the train entering the loop. The Hasler recordings will be the subject of further detailed analysis and review against other evidence.

Relevant to this occurrence, the signalling infrastructure used for standard-gauge traffic through Wallan was damaged as a result of a fire in a trackside equipment hut on 3 February 2020. From 6 February, Train Authority Working was established to manage traffic between Home Departure signals DBK6 and DBK18 at Donnybrook[24] and KME4 and KME16 at Kilmore East.[25]

The alternative safeworking arrangements permits only one train in the section between Donnybrook and Kilmore East at any one time, and Wallan Loop was not being used for trains to cross or pass. From the commencement of Train Authority Working on 6 February, Wallan Loop was configured for trains to travel solely along No.1 Road.[26] This was changed to sole use of No.2 Road on 20 February.

Further investigation

The areas explored and requiring further investigation include:

- Derailment sequence: Further investigation will include a detailed examination and review of available evidence to refine the derailment sequence.
- Track condition: To date, site observations and preliminary review of track data have not identified

CONTINUED PAGE 7

Derailment of XPT ST23 at Wallan, Victoria, on 20 February 2020 (cont'd)

adverse conditions directly contributing to the derailment. Further investigation will include the detailed examination of post- and pre-occurrence track geometry and maintenance information.

- Rolling Stock condition: To date, site observations and vehicle workshop inspections (that commenced 6 March) have not identified adverse conditions directly contributing to the derailment. Inspections are ongoing and include detailed inspection of vehicles and testing of braking and driver safety systems.
- Crew and passenger survivability: Detailed survivability inspection of the leading power car XP2018 and all passenger vehicles is complete.
- A passenger survey is being conducted researching passenger experiences of the derailment and subsequent evacuation and emergency response.
- Train operation: Further investigation will include a detailed examination of the operation of the train drawing on a wide range of evidence sources.
- Management of train operations: A detailed examination of the Alternative Safeworking System as applied at this location immediately prior to the accident. <<<

PLEASE NOTE:

1. The above is an edited extract from the Preliminary Report of the Australian Transportation Safety Bureau. The complete text is available online at http://www.atsb.gov.au/publications/investigation_reports/2018/aair/ao-2018-026/preliminary/
2. A final ATSB Report on this accident is expected to be issued in due course.

Book Review (cont'd)

This is an important book, and perhaps more so than its rather uneven narrative might suggest, in view of the wealth of biographical material concerning a quite remarkable man, brought together here for the first time in this substantial volume (300 + pages).

Inevitably, there are shortcomings. Notwithstanding the "crash course" Ms Branch claims to have undergone, she frequently has difficulty with the technical details, and her suspect knowledge of technology history is like -wise a limitation.

Still, these are tolerable defects, and we must applaud Ms Branch's fortitude in taking on this daunting task in the first place. Certainly, she gives us good reason to endorse the words of former CSIRO historian, Dr Clive Coogan: "Henry Sutton, the closest we've ever come to a home-grown Edison!" <<<

*(Anthony Gascoigne is Managing Director of GNS Associates Pty Ltd. He has held a number of senior positions in IEEE Victorian Section, and is a regular contributor to **Uplink**).*

Professional Engineers Act

As many members will be aware, in 2019 the Victorian State Parliament passed a Bill intended to assure Quality in the provision of professional engineering services and promote engineering quality generally. This new protocol will include the mandatory Registration of certain classes of engineers providing certain classes of services.

The details will be set out in Regulations now being drafted by the responsible government Department. Engineers working under the direct supervision of a Registered Professional Engineer may not have an obligation to register.

We understand that the Act is unlikely to commence operation during the current year, 2020.

The Act is available for download at: https://www.legislation.vic.gov.au/as-made/acts/professional-engineers-registration-act-2019 <<<

Editorial

As 2020 rolls rapidly on, I wish to thank all my *Uplink* helpers over the years for their assistance in putting this newsletter together. I intend to now step down and hand over to a new team.

At the first Section Committee meeting for 2020, our new chair, Dr Mehrnaz Shoushtarian, invited several chapter chairs to outline details of their planned programs of activity for 2020, for the information of the Committee.

As Past Section Chair, I urge all chapter and affinity group chairs to prepare a concise plan of action, to help ensure that we as a Section provide a diverse and balanced program of activities that serves the needs of all our members.

Some six years ago, our car industry started to close down and withdraw from manufacturing in Australia, a move that is now virtually complete. Many smaller manufacturers who provided parts to the car industry were also forced to close. The need to be versatile and diversify was starkly illustrated by this sequence of events. While there were considerable job losses, the rate of unemployment remained essentially unaffected.

However, with the corona virus, unemployment is potentially much higher. The federal government will need to provide funding support to many workers who will be stood down, with unknown consequences for our national economy.

On the other hand, given the number of major projects in planning or already underway, Australia-wide, this may be a good time to commence work: a large pool of skilled workers matched with a corresponding demand for skills, and long-term employment! Government stimuli such as tax write-offs for equipment, will certainly assist this re-adjustment.

Regarding this noble publication, I would remind all readers that articles of interest to IEEE members are in constant demand. These may include short-form technical papers, reports of past events, notices for coming events, and letters to The Editor. And good quality photographs are particularly welcome!

Finally, my best wishes to the incoming Editor and the *Uplink* team, also to all IEEE members of the Section, notwithstanding

I plan to contribute the occasional article, so my connection with the publication will not be completely lost. <<<

Alan L. Harvey, PhD
Editor *Uplink*, 2009 – 2020
IEEE Vic/Tas Section

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VICTORIAN SECTION
...OUR 37TH YEAR!