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The transformation of Engineering Entrepreneur to Multi-faceted Specialist: From Nation-building as depicted by the career of the Scots-Queensland Sir Thomas McIlwraith (1835-1900) to Global technical participant.

Emeritus Professor D. B. Waterson
Department of Modern History, Politics & International Relations
Macquarie University, North Ryde, NSW 2109
Sydney, Australia.

SUMMARY: *This paper examines the role of the "engineer triumphant" in the Nineteenth Century Imperial context to the professions' explosion in the Twentieth Century. The emergence of the consumer society, nuclear engineering, the military/industrial complexes and the challenges to the monumental "Big Projects" such as the T.U.A., The Three Gorges Dam, the Snowy Mountains Scheme, Aswan High Dam, and the Russian river/steppe experiences will be briefly considered. Finally, the role of the finance-based corporate state, the rise of the Green Movement in the West, together with the challenge of climate change, population growth and short-term political programmes will be mentioned within the context of an expanding but often frustrated profession.*

This paper concerns itself with the careers of Sir Thomas McIlwraith (1835-1900) whose involvement in politics, engineering, pastoralism and finance in Queensland during the second half of the Nineteenth Century can be used as a peg upon which to hang aspects of the great age of imperial engineers. The intent is to briefly discuss the British origins of the engineering profession, its flourishing in Victorian times, the optimism generated by taming nature and man and the calamity of the First World War. Finally the changing nature of the incredibly diverse profession, the rise of technology and managerialism and some challenges as the historian sees the contemporary scene will be discussed. Then, too, Samuel Smiles' celebration of the *Lives of Engineers* and the difficulty, in the Twenty-First Century of similar biographies of the great constructors will be considered. As the great New Zealand biographer of James Cook, J.C. Beaglehole noted:

> We still lack the quantity of intimate description we should like, that analysis of character that with all men, great or little, we feel would somehow make all things plain… he was a man of action and the tendency is to regard a man of action as adequately described by his acts, his biography a succession of things done… But acts are public things and we want to enter the mind. (Beaglehole, J.C., *The Life of Captain James Cook*, London, 1974, p. 698)

McIlwraith was born in Ayr, Scotland, on 13 May 1835 – the son of a manufacturing plumber. I need scarcely to remind listeners and readers of the immense contribution of Scotland to most forms of engineering. Of this theme, more later. Educated at Ayr and Wallacetown Acadamies he briefly studied arts at Glasgow University before joining his brother, John, on the Victorian goldfields in 1854. Without formal qualifications he joined the Railways Department at Geelong, became an £800 per annum (a very good salary in those days) engineer in 1859, by 'learning on the job' (Waterson, D.B., *Personality, Profit and Politics*: Thomas McIlwraith in Queensland, 1866-1894, Brisbane, 1984).

McIlwraith joined Cornish and Bruce the contractors for the Melbourne to Bendigo Railway as an engineering overseer. Big Hill tunnel near Bendigo is still worth a visit. He made substantial personal profits, saving thousands on stone from cheaper quarries.

McIlwraith moved to Queensland in 1864 and invested heavily in Maranoa and northern pastoral and sugar properties forming the North Australian Pastoral Company, a pioneer example of a vertically integrated company breeding animals, fattening them, killing and freezing them and exporting frozen meat to Britain. Here was the entrepreneur well aware of the the engineering and technological breakthroughs that were the foundations of the frozen meat trade. (Waterson, *op. cit*, pp. 10-13).

Establishing the Darling Downs and Western Land Company, the Queensland Investment and Land Mortgage Company and the new Queensland National Bank with a mixture of British and local capital, McIlwraith was forced into exile in London, a ruined man lucky to avoid gaol for fraud although some fruitful assets had long been transferred to his wife under the Married Women's Property Act. Gold mining, sugar and copper speculation were, by the Depression of the 1890s, also unsuccessful.

McIlwraith entered colonial politics in 1870, became Minister for Public Works and Mines in 1874 and Premier and Treasurer in 1878-83. An advocate of massive state borrowing for public works, a land-grant Transcontinental Railway – still talked about – the stimulation of large-scale mining and pastoral enterprises and banking and other financial manipulations. In 1890-93 he was the financial power behind the Griffith-McIlwraith Coalition during the great-depression, put down the shearing strikes, quarrelled with the Bank of England and concealed the parlous state of the Queensland National Bank and his own massive overdraft jointly held with the General Manager, Colonel Drury.

He flirted with crude Social Darwinism, Queensland nationalism, advocated imperial expansion through engineering artefacts and single-handedly annexed part of New Guinea against the wishes of the British Colonial Office. McIlwraith even managed to win the unalloyed approval of Francis Adams in his seminal work, *The Australians: A Social Sketch*, London, 1893, pp. 77-78).

There is another point linking McIlwraith's notion of rational improvement, personal performance and the use of engineers to alter the world to western standards. 'Andre' Maurois was aware of this aspect of the nature of British material colonisation: 'Aurelle, rather dazed, fuddled with the Indian sun and the scent of wild animals, at last realised that this world is a great park laid out by a gardener god for the gentlemen of the United Kingdoms (Maurois, Andre, *The Silence of Colonel Bramble*, Melbourne, 1940, p. 33).

Progress and transformation, then, was the goal. But it was to be the material program of the railway engineer turned speculator and improving pastoralist. (Waterson, *op. cit.*, pp. 9. 29). He firmly believed in both the imagery and the transforming power of technology and enthusiastically lauded the practical men of the world in his 1875 lecture 'The Romance of Engineering'. Every word of Carlyle's saga of steam would have earned McIlwraith's unstinted approval:

> Of the Poet's and Prophet's inspired message and how it makes whole worlds, I shall forbear to mention: but cannot the dullest hear steam engines clanking around him? Has he not seen the Sottish brains – Smith's idea (and this but a mechanical one) travelling on five wings around the Cape and across two oceans… at home not only weaving cloth, but rapidly enough overturning the whole system of society… preparing us, by indirect but sure methods, Industrialism and Government of the Wisest (Carlyle, T., *Signs of the Times*, London, 1869, pp. 317-18)

But there is a dichotomy here which Carlyle and later Ruskin acknowledged. Mechanical progress through engineering triumphs may transform the world but what of its effects on human beings, on individual expression and artistic creativity and passion? Carlyle in his *Sartor Resartus* was contemptuous of 'Liverpool Steam Carriages' while Ruskin continued to stress 'Romantic Fairness against a philosophy of gain and wealth' and basically held a nostalgic feeling for long-dead rural life and held engineering solutions as, by implication, no answers for ones population and poverty, mass ignorance and disdain for beauty (Ruskin, John, *Unto This Last: Four Essays in the First Principles of Political Economy*, 7th ed., London, 1890, esp., pp. xi, 156, 167-70).

Here the influence of Samuel Smiles (1812-1904) should be mentioned as a widely-read publicist – paralleling McIlwraith's 1875 lecture. Like McIlwraith, Smiles was also a Scot and can be canonised as the originator of Business and Engineering history (Mathew, H.C.G., 'Samuel Smiles' in *Oxford Dictionary of National Biography*, ed. Mathew, H.C.G. and Harrison, B., 50, Oxford, 2004, pp. 1001-4).

Smiles was a product of the Scot's Enlightenment like so many of his subjects. It was no accident that the University of Glasgow was the first institution in the Empire to have a Chair of Engineering and it is most appropriate that Dunedin, the most Scottish of all Antipodean cities, should host this conference. Smiles stressed the virtues of self-help, self improvement through industry and education as well as duty, perseverance and meticulous mathematical calculation, all qualities which are still part of the engineering profession (Smiles, Samuel, *Lives of the Engineers: The Steam Engine*, Boulton and Watt, London, 1878, esp., pp. 382-3, 406-09. There are a further four volumes dealing with canals, lighthouses, roads, locomotives and bridges).

But for McIlwraith, a successful amalgam of political fireman and development engineer the fulfilment of his dreams and the continuation of his political life depended on Queensland rapidly increasing its population by immigration and natural increase, massive capital investment from Great Britain, high prices for primary products and minerals and world economic expansion and stability. But as the depression of the 1890s deepened McIlwraith's cleverly woven tapestry began to unravel. Then, too, the human machine began to break down. His physical disease, peripheral neuritis, caused by a Vitamin K deficiency and resulting from viral infections, venereal disease, lead poisoning from his father and brothers' lead processing workshops or alcoholism – take your pick – increasingly influenced his ability to deal with a series of crises which went far beyond his ability to diagnose or control. Great forces, as Marx observed in the *Manifesto of the Communist Party* – just when McIlwraith was moving from Victoria to New South Wales were in motion. Indeed part of the manifesto can be read as a hymn to the unleashed powers of engineering in the Nineteenth Century but continued in the Twentieth by the Soviet Union, the People's Republic of China and other States concerned to master their environs.

> The bourgeoisie has created more massive and more productive forces than have all the preceding generations together. Subjection of Nature's forces to man, machinery, application of chemistry to industry and agriculture, steam navigation, railway, electric telegraphs, clearing whole continents for cultivation, canalisation of rivers, whole populations conjured up out of the ground – what earlier century had even a presentiment that such productive forces slumbered in the lap of social labour? (Marx, K., and Engels, F., *The Communist Manifesto*, London, 1847, new ed., Moscow, n.d., pp. 50-51).

Engineering was thus essential, throughout the world, including the colonial areas as Michael Adas has shown, of the creation not only of new societies of settlement but a variety of interlocking and interacting frontiers, the first wave of which we can now see as the deepening hurricane of globalisation (Adas, M., *Machines as the Measure of Men: Science, Technology and Western Dominance*, Ithaca, 1989, esp., 184-97, 220-240, 357-385).

I do not intend to analyse McIlwraith's political skills and superficial reasons for his eventual downfall just noting that his name, unlike that of Alan Bond, is not attached to a university or even a business school, but only an obscure mountain range in North Queensland, a scattering of street names, a couple of portraits hidden away in libraries and, more significantly, engineering scholarships at Queensland University. Even his grave is situated close to his birthplace at Ayr and near a row of Empire airmen's graves, the victims of training accidents at Turnberry airfield, a few miles away. Their deaths were, it has been remarked, a consequence of the planet's first industrial World War which, as we shall see, was essentially a murderous engineers conflict – although few military leaders recognised this at the time.

McIlwraith may have been a polymath but throughout – the exploding frontier of Western penetration and exploitation engineers were at the forefront of the advance. Henry Lawson, when commenting on the failure of the shearer's strikes that, by moving men, arms and materials, the state had crushed, remarked: 'through railways now the mighty bush is tethered to the world'. Lawson went further in 1904 with his nationalist plea for the creation, not of noble shearers and bush denizens of Russel Ward's *Australian Legend* and Bean's Anzac celebration of outback blood and soil virtues, but the metropolitan Australian engineer. The verse is worth quoting in full:

AUSTRALIAN ENGINEERS

Ah, well! but the case seems hopeless, and the pen might write in vain;
The people gabble of old things over and over again.
For the sake of the sleek importer we slave with the pick and the shears,
While hundreds of boys in Australia long to be engineers.

A new generation has risen under Australian skies,
Boys with the light of genius deep in their dreamy eyes—
Not as of artists or poets with their vain imaginings,
But born to be thinkers and doers, and makers of wonderful things.

Born to be builders of vessels in the Harbours of Waste and Loss,
That shall carry our goods to the nations, flying the Southern Cross;
And fleets that shall guard our seaboard – while the East is backed by the Jews—
Under Australian captains, and manned by Australian crews.

Boys who are slight and quiet, but boys who are strong and true,
Dreaming of great inventions – always of something new;
With brains untrammelled by training, but quick where reason directs—
Boys with imagination and keen, strong intellects.

They long for the crank and the belting, the gear and the whirring wheel,
The stamp of the giant hammer, the glint of the polished steel,
For the mould, and the vice, and the turning-lathe – they are boys who long for the keys
To the doors of the world's mechanics and science's mysteries.

They would be makers of fabrics, of cloth for the continents—
Makers of mighty engines and delicate instruments;
It is they who would set fair cities on the western plains far out,
They who would garden the deserts—*it is they who would conquer the drought!*

They see the dykes to the skyline, where a dust-waste blazes to-day,
And they hear the lap of the waters on the miles of sand and clay;
They see the rainfall increasing, and the bountiful sweeps of grass,
And all the year on the rivers long strings of their barges pass.

But still are the steamers loading with our timber and wood and gold,
To return with the costly shoddy stacked high in the foreign hold;
With cardboard boots for our leather, and Brum-magem goods and slops
For thin, white-faced Australians to sell in our sordid shops.

(Henry Lawson, *Collected Verse*, edited by Colin Roderick, Volume Two, Sydney, 1968, pp. 92-93).

Ironically, a decade later it was an Australian engineer of Jewish birth, Sir John Monash who led the First AIF to its great victories and who successfully combined logistics, airpower, tanks and other industrial material in a unique and devastating fashion (Serle, G.S., *John Monash*, Melbourne, 1982).

His contemporary Herbert Hoover, an American mining engineer with a stint on the West Australian goldfields and a brilliant organiser of relief after the First World War, could not adapt his skills to overcoming the worst effects of the Great Depression in the United States. While this President is remembered largely for his omissions and the construction of the Boulder (later Hoover) Dam on Colorado River, his successor F.D. Roosevelt paradoxically used the talents of the engineers on the great Tennessee Valley Authority's schemes and other massive construction feats. To race ahead it was the Corps of Engineers under General Leslie Groves that provided the infrastructure that produced the atomic bomb while the TVA and New Deal provided much of the conceptual influences behind the Snowy Mountains power and irrigation undertaking, itself Australia's largest and most important Twentieth Century engineering feat, presided over by a son of a nation that has produced far more engineers than its population might have been expected to germinate, Sir William Hudson.

But I digress. The autobiography of the Dublin-born railway engineer C.O. Burge whose efforts as a servant of the British Empire spanned five continents. His creed came straight from the British Institution of Civil Engineers: 'The art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states both the external and internal trade' (Burge, C.O., *The Adventures of a Civil Engineer: Fifty Years on Five Continents*, London, 1909, p. 37).

Burge believed with Smiles and McIlwraith that 'to the engineer we owe much to the moral and intellectual progress of mankind' (*Ibid*., p. 38). Working on the great period of Indian Railway construction which, with the English language and a form of social democracy was the Raj's contribution to India, Burge also worked on bridges, Cape of Good Hope railways and, closer to home, what was until the Sydney Harbour Bridge's construction (1932) the largest project in New South Wales, the Hawkesbury River Bridge (1889). As Resident Engineer he and the American contractors employed techniques unrivalled for boldness, innovation and effectiveness. Indeed, the seven piers carrying the structure are still in existence long after the bridge itself was replaced. After the bridge was completed Burge supervised the removal of the Devonshire Street Cemetery's inhabitants who, in the interests of progress, made way for the new Sydney Central Railway Station (*Ibid*., pp. 256-62).

As an interesting sidelight Burge observed that many engineers were also Freemasons. The connection of both crafts to 'the great Architect of the Universe' is clear. Burge was part of Buchanan's 'motley crew' of artisans, practical craftsmen who were mainly of a conservative political bent although, in contradiction to Ruskin, were often of a artistic bent with an ability to see inventions and their implementation in the mind's eye (Buchanan, R.A., 'Gentlemen Engineers: The Making of a Profession', *Victorian Studies*, 26, 1983, pp. 410-11. I am indebted to Professor Caroll Purcell for these and other observations. Purcell, C., *White Heat, People and Technology*, Berkeley, 1994, pp. 47-48).

But even before the disastrous Great War the day of the independent innovative engineer was almost over as a dependence on mathematical formulae and computer models manipulated by a variety of well-trained experts provided 'information rather than insight, and labour marshalled by scientific management' (Purcell, *op. cit*., pp. 47-48). To these developments I would add the demands of corporate and finance capital on politics, both social democratic and authoritarian and the growth of a consumer and rapid replacement society let alone the complexities of an inventor/ engineer increasingly at the disposal of a military-industrial complex (Ferguson, E., 'How Engineers Have Lost Touch', *American Heritage and Technology*, 8, 1993, pp. 16-20).

From the beginning of the Twentieth Century as power shifted from Western Europe to the United States engineers were employed by large corporations such as General Electric, Ford, General Motors and United States Steel. The Europeans as craftsmen/ engineers were still capable of great innovations as radar, penicillin, computers, atomic physics and jet propulsion demonstrated but mass-manufacture was often transferred to the United States and then to Japan and now South Korea, China and India.

If as Purcell claims, the mechanic/ inventor Henry Ford and Frederick Winslow Taylor, a consulting engineer were 'the midwives of the Twentieth Century… it was a mass project based on the principles of power, accuracy, economy, speed and recognition'. These are qualities which all engineers both old and new recognise, but which can be distorted by society's obsession with a mechanical mastery over both nature and other human beings. A useful corrective to this is the screening of Fritz Lang's 1927 epic *Metropolis* or the rapid acceleration into reality of Aldous Huxley's *Brave New World* and the discovery and engineering of the human genome (Purcell, *op. cit*., pp. 94-7). But increasingly engineering's role in the provision and distribution of clean water through sewers, dams, recycling and harvesting techniques will become even more important in the 21st Century as pressure on existing supplies and the effects of climate change become more apparent. C.Y. O'Connor's Western Australian Goldfields pipeline and Maurice O'Shaughnessy's Sierra Nevada-San Francisco water supply are perhaps, like Watt and Stephenson's Steam engines of the previous century, harbingers of a new age celebrated not only in the United States but in Lenin's Soviet Union symbolised by the giant Dnepropetrovsk Dam on the Dnieper. It is no accident that the engineer, unlike army officers, intellectuals and party ikons remained virtually untouched by the purges of the Stalin years (see: Sinclair, B., 'The Profession of Engineers in America', in Purcell, C., *A Companion to American Technology*, Oxford, 2005, pp. 363-384).

I conclude with some observations on the long journey of the engineering fraternity from Watt to entrepreneurs such as McIlwraith, to the corporate team player and now a member of a profession which includes most, if not all facets of our daily life from bio-mechanics to aircraft, from engines to atom and from computers to communications. The challenges facing the profession have been well summed up by Rosalind Williams:

> Their time (little e-engineering) is past and will not come again… but it has left a legacy that provides a solid foundation for the future; confidence in the ability to solve problems, energy and hard work; the habit of teamwork… the delicate balance between investment in and chitance from capitalism; the belief in community and progress; the assumption of responsibility for the material world.
> We are not confronting the death of engineering any more than we confront the death of nature, history or science… But it will be especially painful to make the transition from acting in a familiar mould… to acting in the larger and more disorderly world (Williams, R., *A Historian Confronts Technological Change*, Cambridge, Mass., 2003, pp. 87-88).

Whether or not the eighteen engineer-trained members of the twenty-five strong Chinese Politburo and the new Japanese Prime Minister also a graduate engineer will make a difference remains to be seen (*Encyclopedia Britanica Yearbook*, 2013, p. 415). But I started with a Scot and will finish with a note of cheer to all engineers. Lord Brougham's epitaph to Watt on the colossal monument to the genius in Westminster Abbey is still worth quoting:

Not to perpetuate a Name
Which must endure while the Peaceful Arts flourish,
But to show
That Mankind have learned to honour those
Who best deserve their gratitude,
The King,
His Ministers, and many of the Nobles
And Commoners of the Realm,
Raised this Monument to
JAMES WATT,
Who directing the Force of an original Genius
Early exercised in Philosophic Research
To the Improvement of
The Steam Engine,
Enlarged the Resources of his Country,
Increased the Power of Man,
And rose to an Eminent Place
Among the most illustrious Followers of Science,
And the real Benefactors of the World.
Born at Greenock, 1736.
Dies at Heathfield, in Staffordshire, 1819.

(Smiles, S. *op. cit.*, p. 404)

D.B. Waterson.