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“Clydeside”

by Andrew H. Wilson

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CLYDESIDE

by Andrew H. Wilson

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Abstract

This paper will discuss principally the history (and geography) of shipbuilding and marine engineering along Scotland's River Clyde. It will include mention of the more general history (and geography) of the river itself, and say some things about the cities of Glasgow, Greenock, Port Glasgow and Dumbarton that have grown up along it and its estuary, as well as the large and important Firth of Clyde. In particular, the history will be divided into two periods: before and after 1968. It will also reflect some of the author's experiences as a Clydeside marine engineering apprentice in the late 1940s.

The content will be rooted in engineering history. A number of maps and illustrations have been added at the end of the paper.

About the Series

Principally, the Cedargrove Series is intended to preserve some of the research, writings and oral presentations that the author has completed over the past half-century or so but has not yet published. It is, therefore, the modern-day variant of the privately-published books and pamphlets written by his forebears, such as his paternal grandfather and grandmother and his grandfather's brother John.

About the Author

He is a graduate in mechanical engineering and the liberal arts and has held technical, administrative, research and management positions in industry in the United Kingdom and the public service of Canada, from which he retired over 30 years ago.

He became actively interested in the history of engineering on his appointment in 1975 to chair the first history committee of the Canadian Society for Mechanical Engineering and served both CSME and the Engineering Institute of Canada in this capacity for varying periods until 2003. He has researched, written and edited historical material for both organizations and for the Canadian Society of Senior Engineers. He is also a past president of CSME and EIC.

Preamble

This paper is an extension of the talk I gave to the Ottawa Branch of the Canadian Society of Senior Engineers on 17 June 2019, and is based on the powerpoint presentation for it. The latter had some illustrations and photographs, not all of which have been included....at the end of this paper. *The reader should refer to these from time to time while progressing through the text.*

My interest in Clydeside has been lifelong. My forebears on both sides (Wilson and Dykes, Hastie and Wright) had their roots in the farming communities of South Lanarkshire, through which the Clyde flows. In the decade following World War II, I studied for two degrees at the University of Glasgow and, during the first, also served part of a partial apprenticeship with the Harland & Wolff Company, which built both ships and engines on Clydeside. But shipbuilding, Glasgow and the river itself changed significantly around 1968, some years after I had gone elsewhere. The later sections of the paper deal with some of these changes.

Geography

The River and Firth of Clyde and the cities and towns along its banks occupy much of the southwest corner of Scotland.

The river begins as a 'wee burn,' barely two feet wide, in moorland 1000 feet above sea-level, on the north side of Queensbury Hill in Dumfriesshire. Two other 'wee burns' start nearby and become rivers. The Tweed rises from the Lowther Hills and flows northeast, then due east across the Scottish Borders, to wind up in the very north of England and the North Sea. And from Annanhead Hill, the Annan flows due south to the Solway Firth and the Irish Sea.

Meanwhile, the Clyde runs roughly 100 miles northwest, through Lanark, close by Hamilton and Motherwell to Glasgow, from there to the Bowling Bend, where it begins to widen, then past Dumbarton on the north bank and Port Glasgow and Greenock on the south, to the Tail of the Bank. There, it turns sharply south to the long Firth that leads past the Islands of Bute, the Cumbraes, Ailsa Craig and Arran, and the Mull of Kintyre to the Irish Sea. If you turn right at the Tail of the Bank you can enter the Gare Loch, the Holy Loch, Loch Long and Loch Goil. On Gare Loch, for example, you will find the nuclear submarine naval base at Faslane, once used also as a breakers' yard. The Tail of the Bank was where, during the two World Wars, convoys gathered and dispersed before and after escorted journeys across the North Atlantic, much as they did from the Bedford Basin in Nova Scotia on the other side.

Down river from the town of Lanark, within a dozen miles of Glasgow but not on the river, are the towns of Hamilton, Motherwell, Wishaw, Coatbridge and Cambuslang, which owe their existence to the nearby coal, iron mining and iron- and steel-making operations that once supplied the heavy industries like shipbuilding that grew up on the Clyde in the 19th century. In the same general area are East Kilbride and

Cumbernauld, which came into prominence after World War II as new towns and high-tech locations. The city of Glasgow, its districts and suburbs were once full of engineering companies that supported shipbuilding. Clydeside has also been known for its dairy and poultry farms and for its Clydesdale horses.

The River Clyde has always been quite narrow and, in earlier times, quite shallow from below Bowling up to the city of Glasgow. For a long time, navigation for sea-going vessels on the Clyde began in the middle of Glasgow, at the Broomielaw, just below the series of road and rail bridges that connected the north and south sides of the city centre. There is a tidal barrier across the river, just upstream of the bridges, at Glasgow Green. Built in 1901, it has maintained the upper river water level, stabilized its banks, and provided a channel through Glasgow Green, which received major repairs after a storm in 1943 and a major refurbishment three years later.

It should be remembered that Clyde shipyards not only built new ships, they repaired and refitted old ones and, from time to time, there was more repairing and refitting than building going on. Some were also engaged in ending the lives of ships...shipbreaking. It should also be remembered that shipping on the river could not be done without the continuous services of dredgers and their barges, floating cranes and tugboats. And in the photographs that follow, the reader will notice that the berths/slipways for the Upper Clyde shipyards were often angled to the river to allow for longer up-river or down-river launching distances.

The Broomielaw was famous in years gone by as the starting point for Glaswegian holidaymakers - 'weegies' - sailing in pleasure steamers 'doon the watter' for day trips or longer in the towns around the Firth, such as Gourock, Helensburgh, Dunoon, Rothesay, Millport, Ardrossan, West Kilbride, Fairlie, and Largs. Most of the Firth steamers were owned by the railways and by the Williamson-Buchanan Company. Quite a few of them served in the two World Wars, and some were sunk by enemy action. The Broomielaw also provided regular docking for steamers serving the Western Isles or making the crossing from Glasgow to Belfast.

The Firth of Clyde, incidentally, is the largest and deepest body of coastal water in the British Isles.

Pre-Shipbuilding History

As early as the 13th century, bridges built across the River Clyde at Glasgow limited the upstream movements of wooden-hulled ships with masts.

The earliest industrial activity in the Clyde Valley had to do with textiles, first linens and later cottons, encouraged by government help and the generally damp year-round weather. The Falls of Clyde, near Lanark - the only waterfalls on the river - are where David Dale established a cotton textile plant in the

18th century to take advantage of their power potential. One of his partners was son-in-law Robert Owen, a social reformer, who brought early social planning to the area and to the people who worked at the plant in New Lanark. Silk gauze was also made at Paisley, on a smaller scale. Textiles and clothing items were Scotland's main exports during the second half of the 18th century. They were balanced by imports of tobacco, timber and sugar from the Americas. But the wooden sailing ships that carried them were often built in America and not on the Clyde. And because the river was shallow and sand-barred from the Tail of the Bank to Glasgow, incoming and outgoing goods had to be transhipped to shallower draft vessels or transported to and from the city by land.

The American Revolution, however, changed this and stimulated both the building of ships on the Clyde and the energetic de-silting, dredging, widening and straightening of the river to allow bigger and bigger ships to reach the city. At the same time, the work of James Watt and others in the development of practical steam engines began the change of ships from sailing vessels to steamers. And the Glasgow/Clyde merchants moved their main attention from the United States and tobacco to the West Indies and sugar and the Far East and to trade that involved the rest of Britain and Continental Europe.

Coal became important as a fuel in the 17th century, replacing wood, which was dwindling in supply. But working in the Scottish mines until the late 18th century was little more than serfdom, and the engineering was primitive. Pit props, for example, were not in use until around 1800. The use of women and children in mining was not stopped until the 1840s.

In the late 18th century, coal was first brought into Glasgow from the Coatbridge area by the 12-mile long Moncton Canal, whose engineer was James Watt. Later, iron ore came too. The scows were horse-drawn for many years, before they were steam-driven. Use of the canal was reduced when the railways began to take away its business, and the 1880s saw a big decline in traffic. But the canal was not abandoned until the 1950s. Nowadays a motorway runs along some of it.

The coal mined around the River Clyde in the 19th century came from the Scottish Central Belt, which extended from Ayrshire in the west to Fife in the east, much of it from North Lanarkshire, around the towns of Hamilton, Motherwell, Wishaw, Coatbridge and Cambuslang. It was there when needed for the production of iron.

The mining and exploitation of iron ore, found alongside coal, in Lanarkshire and Ayrshire began in the 1790s. But it was not until the mid-19th century and the early years of railway construction that the substitution for iron for wood in shipbuilding and the development of the open-hearth process that it reached a large scale activity - and later the making of steel and steel-hulled ships.

Clyde shipbuilding on an industrial scale began in the early-19th century at the Tail of the Bank, at Greenock and Port Glasgow on the south bank and at Dumbarton on the north bank. A division in production between the Lower Clyde hulls and the Upper Clyde steam engines was common practice in these days since Glasgow was then the centre for the production of steam engines. And as shipbuilding and marine engineering grew, so did the companies that made the equipment that went into ships, such

as main and auxiliary engines, boilers, pipes, pumps, windlasses, steering gear, chains, anchors and rigging.

Shipbuilding & Engineering History - Lower Clyde and the Firth - before 1968

The Port Glasgow-Greenock-Gourock region of the county of Renfrew, on the south bank of the Lower Clyde, is around 20 miles from Glasgow. It also became known as the Inverclyde district and its shipyards as the Inverclyde yards.

The story of these yards began with the building of wooden-hulled ships on a small scale for fishing and coastal work long before 1800, and before the Upper Clyde and Glasgow were involved. Most were small, were in operation for only a short time, and have not been mentioned in what follows.

The earliest, small Clyde shipyard was established at Greenock in 1712 by the Scott family. The Steele family's connection with Greenock shipbuilding goes back to 1786. By 1830 its yard had expanded considerably, building iron vessels at Cartside for a variety of shipping lines and for British steam packet owners. But it ran into financial difficulties and was wound up in 1883. The Caird family also had Greenock shipbuilding and engineering connections, based on the experience of family members in engineering, beginning in the 1830s. In 1844, it began iron shipbuilding, and the family company was headed by James T. Caird. It built 250 vessels between then and 1888 when James died and his sons succeeded him. A limited liability company was then formed. Its service was mainly to owners with Far East interests. In 1916, Harland & Wolff acquired the shares of Caird & Company. In 1919 the engine works were sold to John G. Kincaid & Company. Harlands expanded the shipyard and steady activity continued into the late 1920s, when the market became erratic. The company was sold in 1935.

The first commercially successful steamboat to be launched and operated on the Clyde was Henry Bell's paddle steamer *Comet*, back in 1812. Built by the John Wood Company of Port Glasgow, John Robertson of Glasgow made the engines and David Napier the boiler. In the early years, this was the normal practice. The American Revolution and the undredged Upper Clyde favoured shipbuilders at Greenock and the Port. Incidentally, the *Comet* carried passengers regularly between Glasgow and Greenock, but was withdrawn from service in 1820.

Meanwhile, Scotts prospered. By the mid-19th century, they were building ships for the West Indies sugar trade and Indo-China clippers, and were moving into steam, using engines made in the Greenock Foundry, which they owned. In 1849, Scotts fitted the new HMS *Greenock* with a screw propeller, the first of many ships the yard provided for the Admiralty. In the second half of the 19th century, Scotts was designing and building liners for a handful of shipping lines with Far East interests. In 1904 the Scott shipbuilding and the Greenock Foundry were combined as Scotts' Shipbuilding and Engineering Company Ltd.. Their Cartside yard and Cartburn dockyard could build annual aggregate gross tonnage approaching 80,000. During World War I, Scotts built ships and engines for the Admiralty, including

submarines, and for civilian owners, and employed several thousand workers. Orders in the 1920s were principally for passenger and cargo vessels. The company survived the 1930s and the Depression thanks to orders from the Admiralty. Naval construction dominated during World War II, but the company's plant was attacked during the German blitz of Clydeside in 1941 and the engine works was badly damaged. Postwar, the yard was modernized and the company returned to the production of passenger and cargo vessels. In the 1950s it built tankers and bulk carriers. The 1960s saw further updating of the yard and Scotts was able to build larger tankers and bulk carriers. In 1965, as mentioned later, it took over Scott and Sons of Bowling.

Lithgow's, shipbuilders of Port Glasgow, began life as a three-man partnership in 1874 between Joseph Russell, William T. Lithgow and Anderson Rodger. They leased the Bay yard at Port Glasgow, in 1879 a second at Greenock, and in 1881 bought the six-berth Kingston Yard. From 1882 to 1892, using standard designs, the partners could build quickly and in this decade completed over 200 ships. However, in 1891 the partnership broke up. Lithgow took the Kingston yard (which he kept) and Greenock yard (which he sold). In 1901, he then brought his two sons, James and Henry, into the business. They took it over when he died in 1908 and expanded it. Their yard's World War I output was significant, but only one naval ship was included. In 1919 the (private) company renamed itself Lithgows and began the process of acquisition and expansion over a 20-year period, adopting the technique of vertical integration, from coal mining to steelmaking, although some shipbuilders and marine engineers were included. Lithgows came to own all of the Port Glasgow yards, producing cargo ships, tramp steamers and oil tankers. James Lithgow was knighted in 1925. The Lithgow yards survived the Depression, but with reduced output. During World War II, they built 97 ships, none of them for the Royal Navy. After the war, Lithgows built cargo ships, tramp steamers and especially oil tankers. Henry died in 1948 and James in 1952. In 1955, Lithgows set out to win full control of competing Ferguson Brothers, also of Port Glasgow, which they achieved in 1961.

There have been two Ferguson shipbuilding companies. The first - geographically in Upper Clyde - was opened in 1885, at Paisley, on the White Cart River, southwest of Renfrew, by William Y. Fleming when he bought an existing yard, to which he moved his engineering business. In 1895, Ferguson joined the firm and it was renamed Fleming & Ferguson. The yard was in business for over 100 years and specialized in dredgers and their hopper barges, crane ships (with cranes built by Arrols), ferry boats and small river and coastal vessels. In 1965, its assets were bought by the Alexander Stephen Company.

The second company was derived from the first when, in 1902, believing the Paisley one would fail, the sons of William Y. Fleming set up on their own as consultants and leased a shipyard at Port Glasgow, in Lower Clyde. Their first order was for two steam tugs, whose engines were built elsewhere. By the time they had built a third tug, they had their own engine shop. They also began building dredgers. The yard site was bought in 1907 and in 1912 the company became Ferguson Brothers (Port Glasgow) Ltd.. In 1913, it built a bucket ladder dredger, which was sunk by a German raider in the Indian Ocean at the beginning of the war as it was heading for its destination in Australia. During World War I, the yard built 29 vessels, including minesweepers, trawlers, hospital ships and tugs. The 1920s, however, brought no

business until 1928, when a research ship for the Antarctic was ordered. During World War II, the yard produced 30 ships, including tugs, minesweepers, corvettes, ferries and boom defence vessels. Postwar, the Ferguson family still dominated the company's management, but in 1955 a minority share was sold to Lithgows, and full control in 1961.

Across the estuary from Greenock and Port Glasgow, the Denny Company has built ships at Dumbarton, on the River Leven at its confluence with the Clyde, ever since the William Denny formed a partnership to do so in 1814. On his death in 1844, three of his sons set up a partnership, known as Denny Brothers to design and continue building iron steamers. By 1849, one brother had left the partnership and another had joined and the name had been changed to William Denny & Brothers. In 1850, Peter Denny set up a separate marine engineering company with two partners - known as Tulloch & Denny - to fit out the hulls his brothers were building and had previously been sending up river to Glasgow to have the engines installed. William died soon after this, and Peter took the lead in managing both companies, as well as investing in ship-owning and operating companies. In 1867, the Denny activities were consolidated at a new yard built at the mouth of the River Leven. In the 1870s, Walter Brock, a nephew of Peter Denny, developed a quadruple expansion engine and William Denny III, Peter's son, successfully persuaded his father to undertake speed trials for ships on a measured mile, and to build a large experimental towing tank for testing ship models, the first in the world in a commercial shipyard. He also pioneered the construction of double bottoms for ships. Meanwhile, father Peter was taking a great deal of interest in a number of shipping companies and ventures and shipping designs with Far East and South American connections. But tragedy struck when William took his own life in 1880. The Denny companies survived both this and, later, World War I. In 1918, the two Denny companies amalgamated as William Denny & Brothers Ltd.. In 1922, the well-qualified Maurice Denny (of whom more later) became its chairman and guided it for the next 30 years. But for much of the 1920s times were difficult. Steel was short, shipping was in over-capacity, markets were depressed, and competition had grown, especially in the Far East. However, Denny's retained its growing reputation for research and innovation in areas such as high pressure steam turbines and ship stabilising systems. The Denny-Brown stabilizer, for example, was developed in 1936, using Denny's tank, by Maurice Denny and William Wallace of Brown Brothers of Edinburgh. During World War II, Denny's produced warships, merchant ships and paddle steamers. But the postwar market proved to be difficult. The company built mostly coastal vessels, both passenger and cargo, in an atmosphere of stiff competition. It also produced some of the early roll on - roll off ferries. In 1959 the yard was modernized, but business failed to improve. In 1962, a decade after Maurice Denny retired, the company went into voluntary liquidation.

On the north side of the Clyde, about five miles up the north bank of the river from Dumbarton is the village of Bowling, famous for its river bend as well as for being the western terminus of the Forth and Clyde Canal and, in Roman times, the western end of Antonine's Wall between the same two rivers. It has also been the home of Scott & Sons, shipbuilders. In the late 1840s, the shipbuilding McGill brothers joined with James Scott to form Scott & McGill, which became Scott & Sons in 1851. Over the years, the yard built tugs, coasters, fishery protection vessels, and trawlers. It also contributed to technical innovation. In 1958, for example, the tug *Hutton Cross* was the first in the UK to be fitted with a Voith-

Schnider propulsion system and the first to be fitted with bridge controls. That same year the company became Scott & Sons (Bowling) Ltd.. In 1965, it was taken over by Scott's Shipbuilding & Engineering of Greenock. Bowling used to be the place on the river where some of the Clyde summer passenger steamers were 'parked' for the winter.

Finally for the Lower Clyde, two yards on the Ayrshire coast of the Firth should also be mentioned.

The Ardrossan Shipbuilding Company was formed originally in 1842 as Barr and Shearer, but the name was changed in the 1870s. In 1891 it acquired limited liability status as the Ardrossan Dockyard Ltd.. Eight years later, the company was reincorporated as the Ardrossan Dry Dock and Shipbuilding Company. Its yard was expanded during World War I to five berths and 2300 employees and built minesweepers and other small warships, colliers and a coaster. Between the wars, the yard had a variety of names, ownerships and managements. During World War II, it built coasters, trawlers and boom defence vessels. In the 1950s it built small cargo liners, for foreign owners.

The Ailsa Shipbuilding Company was established in 1885 by the Marquis of Ailsa and was based at Troon, almost next door to Ayr. In 1901 it became a private company, owned by the Marquis and his associates, and acquired limited liability. In 1902 it took over a six-berth yard in Ayr. From then until 1929, the yard built 200 ships, including coasters and sailing ships, as well as a polar exploration ship, and a paddle minesweeper, gunboats and sloops for the Admiralty during World War I. Its main customer during the 1920s was the General Steam Navigation Company, for whom it built coasters, coastal liners and paddlers. There was no recorded work for the 1930s. During World War II, Ailsa built minesweepers and other vessels for the Royal Navy, as well as a hospital ship and coasters for other owners. Postwar, it built colliers, cargo-liners and more coasters. By the 1960s it was building car and passenger ferries and, in 1961, had 750 employees.

Shipbuilding & Engineering History - Upper Clyde - before 1968

The Upper Clyde shipyards that are mentioned in what follows are only a few of the many - some of them quite small and short-lived - that served the industry on the river since iron shipbuilding began on the Upper Clyde in the 1840s. With the exception of Beardmores, they were also in business until at least the 1960s.

The Govan, Linthouse and Renfrew yards were on the south side of the river and all the others, from Pointhouse to Clydebank, on the north. It is roughly seven miles from the Broomielaw to Clydebank.

The yard facilities nearest the Broomielaw, at Govan on the south side of the river were acquired by Belfast-based Harland & Wolff in 1912. Edward Harland and Gustav Wolff had established their shipyard at Queen's Island Belfast in 1858. Their successors acquired an interest in yards on the Clyde that had been owned by the Napier, Beardmore, Mackie and Thomson shipbuilding companies, which they turned into a modern shipyard with six berths, a fitting out basin, and new workshops. The H&W marine

engine-building plant was up-river of the yard, at Finnieston, on the north side of the river. The company also had a foundry in Govan and another engineering plant in Scotstoun which did not contribute to shipbuilding. The yard made significant contributions to ship and engine-building in both World Wars. Postwar, improvements were made to the workshops and other facilities at the yard, which specialized in building tankers and cargo ships. Between 1946 and 1963, when the yard was closed down, it built some 54 ships. After its closure, the site eventually became a housing development.

The land in Govan on which the Fairfield shipyard was built was originally a farm. As a shipbuilder, and over the longer haul, Fairfields and John Brown were perhaps the best known of the Clyde shipyards. They both built very large passenger vessels and very large warships.

In 1858, the Old Shipyard at Govan was acquired by a company headed by Charles Randolph and John Elder. In 1864, the yard moved to the Fairfield Farm. It changed its name two years later to the Fairfield Shipbuilding and Engineering Company, by which time Sir William Pearse owned the company, and was building express liners, coastal vessels and steam yachts, and the steam engines for them. Pearse died in 1888 and was succeeded by his son, Sir William G. Pearse, who was less successful than his father. However, in 1894, the company's fortunes were revived when Edward Shearer was appointed general manager. In 1897 the yard was destroyed by a major fire, and was rebuilt. Between then and World War I, Fairfields built many ships for the Admiralty as well as for Canadian Pacific Steamships, in which the younger Pearse had an interest. He died in 1907. During World War I, the company built 50 warships, including nine submarines. Work slowed again in the early 1920s, revived, and dried up again during the early 1930s. The pick up of orders began in 1935 and by 1939 Fairfields was building for the Admiralty again. During World War II, the Govan yard built battleships and aircraft carriers as well as destroyers and LCT's, and continued to build navy ships and large ocean liners in the immediate postwar years. In 1961, Fairfields acquired the David Rowan engine company. In the early 1960s, it underwent a modernization program but, by 1965, times were sufficiently bad that it had filed for bankruptcy, but it was reorganized and continued in business.

Alexander Stephen started building wooden ships in 1750 on the Moray Firth. In 1828, Alexander Stephen & Sons moved to Aberdeen, then to Arbroath and Dundee, arriving at Kelvinhaugh, just west of what became Queen's Dock, in Glasgow in 1850. In 1868 they bought the Linthouse Estate on the south side of the river, and west of the Fairfield Farm, for their new shipyard. Up to 1871, the company specialized in sailing vessels, but then changed over to steam-driven cargo and passenger vessels. It continued to be run by the Stephen family. They built both ocean liners and cargo ships and were associated with the Anchor Line and Elder & Fyffe, as well as ships for the Royal Navy. By 1900, it was a limited liability company, but family members remained the major shareholders. Stephens, too, built ships for the Royal Navy during World War I. In 1919, however, the P & O Steam Navigation Company - a major customer - took control. But the 1920s were lean years and this continued to 1932, when Alexander Murray Stephen became chairman. Over the next decade his contributions to British shipbuilding industry as a whole were significant. He also had considerable interest in the technical aspects of shipbuilding and in the upgrading of his yard's equipment. Stephens made its contributions to

World War II shipping needs, and to postwar needs. In 1946, it became a public company. However, when Murray Stephen retired in 1965 and, in spite of his efforts, the company was in financial trouble.

Moving to the north side of the river, and opposite the Harland & Wolff yard, the A&J Inglis Pointhouse yard sat at the confluence of the Rivers Kelvin and Clyde.

In 1847, Anthony and John Inglis had set up a business in marine engineering in Warroch Street, Finnieston. In 1862, they added shipbuilding to the business, acquiring land for their yard at Pointhouse, not far from Warroch Street. They built iron steamers for British and foreign owners. Anthony died in 1884 and his son John Jr. took his place. In the 1880s, the company built tankers and cargo ships but, after this, concentrated on small coastal vessels. By 1905, Inglis was a limited liability company and its main output was paddle steamers for railway service on the Clyde. Before and during World War I, it built vessels for the Royal Navy, including the HMY *Alexandra* for King Edward VII. In 1917, Harland & Wolff bought controlling shares, but Inglis remained independent. In the 1920s, it built a variety of vessels, mainly for South American companies, but was largely idle during the Depression. In 1935, however, Inglis built the PS *Talisman*, claimed to be the first direct-acting diesel paddle steamer in the world. Postwar, it built the replacement paddle steamer, PS *Waverley*, initially for railway service on the Firth, and a variety of other coastal vessels, including 14 whale catchers for a Norwegian company. The company closed down in 1963 and the yard was converted to a trading estate. In 2011, it became the home of Glasgow's Riverside Museum of Transportation and Travel. In its 101 years, Inglis company built around 500 ships.

Around 1874, after the yard that had been used by the Todd & McGregor Company at Meadowside, Partick, on the west side of the River Kelvin where it enters the Clyde, was sold to David and William Henderson. The brothers were also partners in the Anchor Shipping Line, which supplied D&W Henderson with its first ship and engine orders. But both the Hendersons had died by 1895. Until 1900, the company continued to build steamships. That same year, the yard was incorporated as D & W Henderson and Company. Prior to World War I, it built passenger and cargo liners mainly for Chinese and Japanese shipowners. By 1917, Harland & Wolff had acquired the company and taken over the management of the yard. It produced over 30 cargo ships before closing in 1935 and going into receivership, as the effects of the Depression were felt. However, the following year a ship repair facility - D&W Henderson Ltd. - was formed, which ensured that Harlands could continue using the Henderson drydocks. During World War II, the yard was used to build landing craft. It continued in the repair business after the War but was closed in 1962 when Harlands began abandoning the Clyde.

John Barclay started building wooden ships in 1818 at Stobcross, a mile-and-a-bit down the north side of the river from the Broomielaw. Robert Curle became his partner in 1845 and they began building iron ships two years later. In 1855, the Barclay Curle operations were moved to the Clydeholm yard in the Whiteinch district on the north bank of the river, west of Stobcross. In 1912, the company bought the Elderslie Dockyard, between Scotstoun and Yoker, to handle overflow from Clydeholm. That same year, Swan Hunter took over Barclays, including the Clydeholm and Elderslie facilities and the company's

drydocks at Govan. A marine diesel manufacturing plant was also acquired. The company continued building ships for the British India Line until World War I. During it, Clydeholm built cargo ships and Elderslie repaired them. In the 1930s Barclays began building tankers, and managed to keep going during the Depression. In the 1940s, cargo vessels and liners were built, and in the 1950s a variety of high-end vessels for many customers as well, and this continued into the 1960s. However, by 1967 Swan Hunter had closed Clydeholm, and shipbuilding had stopped by 1968, although engine-building continued until the late 1970s.

The Charles Connell & Company shipyard was founded in 1861 and was under family management for the next 100 years, during which time 500 ships were built, beginning with sailing ships for the China trade. It was building steamers in the 1870s. By 1902 it was a private company. By the time steam turbines were being used in ships, Connell was building them for the Ben Line and T&J Harrison of Liverpool, also for the Far East trade. The company contributed naval and cargo ships during World War I and, in 1919, underwent modernization. It was kept busy enough to survive the difficult 1920s, but had to close for eight years during the Depression. During World War II, Connells made cargo liners, but also spent the 1940s doing repairs. Between 1946 and 1968, it completed around 40 tankers and cargo ships.

The Blythswood Shipbuilding Company was set up in 1919 by Hugh MacMillan and Donald Bremner, who were already experienced in the industry. Its initial orders were for tankers, but little other business followed during the slump of the 1920s. By 1925, however, the company had started to build tankers again. In 1928, it was bought by the Northumberland Shipbuilding Company, and went on to build 120 ships between then and the closing of the yard in 1964. Yarrows bought the property to extend their own yard.

Alfred Yarrow started building ships on the north bank of the Thames, near London's dockland, in 1865. Successful, the company had to move to larger space for its operations. Along the way, it built the first destroyers for the Royal Navy, and ships for other Navies. It developed a new type of water-tube boiler, which was patented and was used extensively in ships, but also in locomotives and for electricity generation. Forced to move again, Yarrow chose to come north, to the Clyde, to a 'greenfield' site at Scotstoun, downstream from Whiteinch. The yard was in production by 1908. It included an early Clyde covered fitting-out berth, suitable for two 'slim' destroyers or frigates and was productive during wet and stormy weather. Yarrow's connections with the British Admiralty ensured its healthy survival through to 1968 and beyond. It also built smaller merchant vessels, for example, for riverboat service in South America and the Far East. It built re-assemblable 'knock-downs' for service in lakes with no access to the sea. Yarrows built more covered berths after taking over the Blythswood yard in the 1960s. Yarrows established a presence in Canada in 1893, when it opened a yard at Esquimalt, B.C..

The Thomson fathers, James and George, who had been trained by Robert Napier, established engine and boiler plants at Anderston in 1847 and, in 1850, began shipbuilding at the Clyde Bank Iron Shipyard at Govan. By 1871, the company was being run by the Thomson sons, also James and George. However,

the Clyde Navigation Trust (CNT) wanted the land for dry docks. So the brothers bought a greenfield site down river, on the north side near the village of Dalmuir and at the confluence of the Clyde and its south-side River Cart tributary (which allowed very large ships to be launched) and re-established their yard. Later, the engine and boiler plants were transferred to Dalmuir. With the transfer of Thomson workers to the new site, the town of Clydebank was born. By the 1880s, the company occupied over 50 acres, employed several thousand men, and began the changeover from iron to steel hulls. It built a variety of vessels, from paddle steamers for local Scottish service to transatlantic 'Blue Riband' winners and vessels for the Royal Navy. However, after a slump in orders in 1897, the Thomson Family sold the company to a consortium. In 1899, it was acquired by John Brown and Company, steelmakers, of Sheffield. By 1913, the first of Brown's very large ships, the RMS *Aquitania*, had been launched, her on-board equipment influenced by the recent sinking of the RMS *Titanic*. During World War I, Brown's built a number of very large ships for the Royal Navy, including HMS *Repulse*. During the Depression of the 1930s, the building of the RMS *Queen Mary* was interrupted and its work force laid off...until the British Government rescued it. Brown's yard continued to build many ships for many owners during World War II and afterwards, including the RMS *Queen Elizabeth*, the battleship HMS *Vanguard*, RMS *Queen Elizabeth II*, and the HMY *Britannia*. It was also the most damaged yard during the German Blitz in 1941.

Until the 1930s, John Brown's neighbour to the west was the Beardmore yard. In view of the origins and product breadth of this company, it has been included below among the notable companies.

Moving across the river to Renfrew...actually farther up-river than Paisley...

The William Simons & Company's yard had been at Renfrew 1860, having been in business elsewhere since 1810. The yard specialized in building dredgers and the hopper barges that serve with them. Simons occupied the old Renfrew East Yard. The Lobnitz & Company occupied the old Renfrew West Yard. Danish-born Henry Lobnitz had previously joined James Henderson & Son at the West Yard in 1857. His company also specialized in dredgers, but with emphasis on rock breaking and cutting techniques. The two companies amalgamated in 1957, as the volume of business declined, but closed in 1964. Some 1300 dredgers, tugs and barges had been built at the site in over a century.

Docks, Cranes, Ferries and Tunnels

Before 1968, the quays along the River Clyde in the port of Glasgow, from the Broomielaw to Clydebank, provided docking, loading and unloading facilities for visiting ships. These facilities were supplemented in the Upper Clyde by five docks.

The oldest and farthest up-river was Kingston Dock, behind Windmillcroft Quay on the south side of the Broomielaw. It was built in 1867, initially to accommodate sailing ships, its entrance protected by a swing bridge. For the most part, it accommodated the 'puffers' and other small craft that plied the river, coastal waters and the Western Isles. It was closed in 1966 and filled in to make way for the building of

the Kingston Bridge as part of a new motorway through the city. Housing was built on the reclaimed land.

Queen's Dock (originally Stobcross Dock) was first opened in 1887 and completed in 1890, on the north side of the river, a mile or so from the Broomielaw. It had a central pier and north and south basins, a total quay space of nearly two miles, and a steam-driven hydraulic power and pumping station which used high-pressure water to drive its entrance swing bridge, cranes and capstans. Queen's Dock was closed in 1969, filled-in in 1977, and later re-developed (as noted below).

On the opposite side of the river from Queen's Dock was Prince's Dock. It was formally opened in 1897, had three basins with two finger piers and large two-storey warehouses on its quays. It had two hydraulic pumping stations, but no swing bridge. It was closed and partially filled-in during the 1970s, and later redeveloped (again as noted below).

The Rothesay Dock is on the north bank of the Clyde, to the east of the John Brown shipyard at Clydebank. Part of the 75 acres that it occupies had previously been owned by the Yoker shipbuilding yard. A two-basin dock with an unobstructed entrance, it was opened to traffic in 1907, was to specialize in the transshipment of coal and other minerals, and was directly linked to the railway. Its equipment included four very large coal hoists. It was also used for fitting out new ships. This dock was the first to be equipped with steam-generated electrical, rather than hydraulic, power. The dock was opened by Prince George, Duke of Rothesay, who later became King George V - and opened the dock that bears that name.

King George V Dock is at Shieldhall on the south side of the Clyde, west of the old Stephens yard and across the river from where Connells used to be. It was opened in 1931 by His Majesty as a multi-user port terminal with an unobstructed entry, especially for larger vessels. It consists of a single long basin set at an angle to the river, a water depth of about 20 feet, state-of-the art equipment, extensive rail and road connections, and a great deal of sheltered storage space.

The King George V and Rothesay Docks have remained open since 1968, and are still in use.

Also, the Clyde Navigation Trust (CNT) built, owned and operated three graving docks at Govan adjacent to the Napier/Beardmore/Mackie/Thomson (later Harland & Wolff) shipyard, the first from 1875 and the third from 1898. They were extensively used for ship repairs. All three were closed in 1988, for later development. Other graving/dry docks were built, owned and operated by the individual yards.

On the Lower Clyde, the building of the James Watt Dock at Greenock began in 1878 and was completed eight years later. It was intended, since increasing volumes of transatlantic shipping traffic were passing up-river to Glasgow, that it would allow Greenock to compete with Glasgow, and especially for larger ships. An Arrol *Titan* crane was added in 1917. For many years, and apart from times of war, raw sugar was the commodity that arrived oftenest at the James Watt sheds, en route to the nearby refineries. Beginning in the 1980s, these sheds fell into disuse, as did the Dock itself. It is now being actively

regenerated as a marina for recreational purposes.

The Inchgreen Drydock was built by the Firth of Clyde Dock Company at Greenock between 1962 and 1964 and was one of the largest in the world at that time, having a length of around 1000 feet and a depth of 50 feet. It was fully used until 1966 and then suddenly closed. Lithgows bought it in 1966 and began using it sparingly. It has hardly been used since 2000 and its two large cranes were demolished in 2017. Its present owners, Peel Ports, insist they want it to be a working dock.

Before 1968 there were hundreds of cranes in use in the yards and docks on Clydeside. There are few now left to work or remain idle or simply to be on display. One of latter is the huge Finnieston crane, erected on the river quay near Queen's Dock and the last of the large ones to go into operation, in 1931. This CNT-owned 175-foot-high crane (also known as the Stobcross crane, after the quay on which it sits) is of the giant cantilever (hammerhead) jib variety, no longer in working order since 1988, but retained as a symbol of the city's mercantile past. It was installed to assist with the loading of large Glasgow-built steam locomotives and armaments (weighing up to 175 tons) into ships for journeys to every part of the world, as well as lifting large marine engines into place in new ships. When working, the movement of the jib was in discrete jerks, to prevent the load at the end of the cable from swinging and making placement in a ship's hold dangerous as well as difficult. The crane was built by Cowans, Sheldon & Company of Carlisle.

While the Finnieston crane was the largest hammerhead on the Clyde, the best known of the large hammerheads were the *Titan* cranes. Designed by Adam Hunter and built, with two exceptions, by Sir William Arrol & Company of Glasgow, with electrically-driven machinery installed by Stothert and Pitt Ltd. of Bath, the first *Titans* date from 1907 and a dozen or so of the original 42 still exist around the world. The first *Titans* could lift loads of 150 tons, but the later or modified higher capacity ones could manage 200 tons. The oldest surviving *Titan* was installed at the John Brown shipyard at Clydebank in 1907 and served during the fitting out of the very large ships Browns built. It survived the German bombing attacks in 1941. This *Titan* was retired from service in 1971. One of four surviving on the Clyde, it has now been restored as a tourist attraction with a 164-foot lift to carry visitors to the top of the boom. The 'exceptional' builders were the Motherwell Bridge Company and Babcock Wilcox of Renfrew, and both cranes were exported.

While bridges and small boats could be used to move people and vehicles across the Clyde above the Broomielaw, below it the need was for ferries. At first, rowboats sufficed. But eventually, and until quite recently, powered ferryboats played a significant part in moving them up and down and across it, within the city limits. One such service was provided by the *Clutha* boats, belonging to the CNT, that travelled up and down the river, calling at ten stops between the Broomielaw and Whiteinch - a round trip of about an hour. Small steam-driven passenger vessels, the *Cluthas* operated from 1884 until 1903 when the streetcar service on both sides of the river put them out of business. They were 70 feet long and used floating landing stages. The two largest ones could carry as many as 300 passengers.

A steam-driven vehicular ferry provided cross-river services between Mavisbank and Finnieston from

1890 until 1966. The ungainly-looking vessel had a movable vehicle deck to accommodate different tide levels at the fixed docking places. In 1905 a vehicular ferry was added at Whiteinch-Linthouse. Both ferries were withdrawn in 1963.

A single deck, steam-driven, chain-operated, fixed structure ferry carrying both vehicles and passengers operated between Renfrew and Yoker for many years. A passenger service has since replaced it. Five other small cross-river passenger ferry services operated on the river between 1890 and 1966, at Finnieston, Govan, Partick, Whiteinch and downstream, below Renfrew, at Erskine. These vessels could carry up to 90 passengers.

At Finnieston, also, there was a roadway tunnel system under the river, with three 16ft-diameter parallel tunnels, their entrance/exit rotunda buildings clearly visible on both sides of the river. Built in 1895, the tunnels were accessed by large Otis elevators inside the North and South Rotundas. The outer two tunnels were for horse-drawn vehicles and the centre one for pedestrians. The vehicular ones were taken out of service in 1943 and the elevators removed. The pedestrian tunnel went out of service in 1980.

Since building a bridge was still inappropriate, a new roadway tunnel beneath the Clyde between Whiteinch and Linthouse and downstream of centre of Glasgow was opened in 1963, when the two vehicular ferries were withdrawn, to accommodate cars and trucks, cyclists and pedestrians. The two circular two-lane tunnels have decks, above which are the vehicle roadways, and underneath the ventilated cyclist/pedestrian ways. Because of their high usage, and in spite of being short, the tunnels have undergone frequent maintenance and repair closures.

Some Notable Companies and their People - before (and after) 1968

Clydeside is famous for its ships and their engines, but it was also home to companies that made the materials and components for these and other fields of engineering endeavour. So in addition to the yards that built ships, a spectrum of supporting materials, mechanical and electrical engineering companies has existed, some of which served wider markets and enjoyed separate reputations.

The iron- and steel-producing companies that supported shipbuilding and other industrial endeavours along Clydeside were based principally in Lanarkshire, close to the original supplies of coal and iron ore they needed for their processes. Their rapid growth is shown by the increase in Scottish steel production from 1,200 tons in 1873 to 58,500 tons in 1890.

The Clyde Iron Works was in business from 1786 until 1978. Located within the city of Glasgow, in 1828 it was the site of the first use of a hot blast furnace which, using local coal, reduced the cost of producing iron. It obtained its ironstone from Monklands. In 1931, Clyde Iron was taken over by Colvilles and, in 1939, integrated into the Clydebridge Steelworks. Both plants were operated by the British Steel Corporation (BSC) from 1967 to 1977, when the Iron Works was shut down.

Merry and Cunningham founded the Glengarnock Iron Works on Kilburnie Loch, well to the west of Glasgow, in 1843. By 1872 the number of blast furnaces had been raised from 8 to 14. They were rebuilt in 1884 to achieve higher output. Glengarnock had its own iron ore and coal mines. Steel was first made in 1885 and cogging and plate mills were added later. The rolling of steel joists was developed, and the company was the first in Scotland to make H-beams for structures and bridges. In 1892 an open hearth melting shop was added. In 1915, the plant was leased to Colvilles to meet wartime demands. The following year, Colvilles bought the plant and managed its output, making many additions to the equipment. The plant worked to full capacity until the miners' strike in 1921. There was little activity between then and 1936, when business revived. World War II brought further expansion and efficiencies. In 1967, with Colvilles, Glengarnock became part of the British Steel Corporation. In 1978, part of the plant had to be closed down, and in 1985 the rest of it was closed.

In the village of Gartcosh, in the coal-iron mining area of North Lanarkshire, the Fireclay Works were established in 1863. Two years later, William Gray started an ironworks. It was sold to E&W Smith in 1867, who formed the Gartcosh Iron and Steel Company. Between then and 1953, when Colvilles acquired ownership, the company went through several owners and activities. In 1963, Colvilles set up a cold reduction mill at Gartcosh to work in conjunction with their Ravenscraig plant. Ravenscraig made hot-strip steel, which had been processed first at Gartcosh. It also produced slab steel for the Dalzell plant, which made plate for shipbuilding and off-shore platform construction.

David Colville founded the company that bears his name in 1871, to make malleable iron, beams, bars, etc. at its Dalzell plant at Motherwell. In 1880, the plant switched to mild steel, for shipbuilding and boilermaking. David Colville died in 1898 and his son, also David, led the expansion and modernization of the company. By 1914, it was using the open hearth process to make a variety of steels in a variety of products. In 1916, Colvilles took over the Glengarnock Iron and Steel Company of Kilburnie and the Clydebridge plant and enlarged them and its own the Dalzell plant to meet wartime demand. Colvilles also bought a colliery to safeguard its coal supplies. As well, Harland & Wolff and John Brown bought shares in the company to safeguard their steel supplies. By 1920, Harlands controlled Colvilles. In 1930, it became a public company, and in 1931, Lithgow interests acquired holdings in it. Laterly, when Ravenscraig came on line, Dalzell focussed on steel products. Its last open hearth furnace closed in 1978.

The Clydebridge Steel Works began production in 1887. However, it was hampered from the beginning by continuing labour problems, but these did not inhibit considerable expansion of steel-producing equipment over the next few years. The outbreak of World War I brought increased business and new management. Colvilles decided to buy the plant in 1915. Even through the roller coaster markets of the 1920s and 1930s, Clydebridge managed to survive to 1939 and wartime prosperity and to become one of the largest integrated steel mills in the country in the 1970s.

The Lanarkshire Steel Works began modestly and privately in 1889 at its Motherwell plant, with a former Colvilles man in charge. It became a public company in 1897. It made joists and sections for ships, structures, gantries and other applications. By 1954, it was part of Colvilles.

Construction of Colville's very large Ravenscraig steelmaking plant began in 1954 and the first operations began three years later with three furnaces, several coke ovens, a blast furnace and an open-hearth melting shop. The strip mill was installed by 1962. At the height of its activity, Ravenscraig employed 13,000 people.

Colvilles and its plants were nationalized by the Labour government in 1951 and denationalized by the Conservatives four years later. In 1967, they were again nationalized as part of the British Steel Corporation (BSC). The Corporation was privatized in 1988.

More, post-1968, on Ravenscraig, Clydebridge and Dalzell below.

Robert Napier, cousin to David, was born in Dumbarton in 1791, where his father was a well-established millwright and engineer, for whom he worked at the beginning of his career. His mother was from the Denny family of Dumbarton shipbuilders. As a journeyman, he moved to Edinburgh to work for the lighthouse builder, Robert Stevenson. Back in Glasgow in 1815, he went into business for himself at Parkhead Forge, building stationary steam engines. In 1823 he built his first *marine* steam engine. As his reputation for high quality workmanship grew, so did his order book. By 1835, he was building engines for ocean-going ships. In the early 1840s, Napier established himself as a shipbuilder, at Govan, switching successfully from wooden to iron hulls. One of his customers was Samuel Cunard, then in the process of building his fleet of ships. Napier befriended Cunard, and encouraged other shipbuilders to 'get close' with shipowners. Many did. His career lasted into the 1870s. With the help of his foreman, David Elder, he also trained a number of engineers who later led shipbuilding and marine engineering companies on the Clyde. With time, Napier has become known as 'the father of Clyde shipbuilding' and the reason that *Clydebuilt* became synonymous with first class engineering, manufacturing and service.

Among the companies was the William Beardmore Company which, over the years, built ships and their engines but also made many other products. Its origins go back to 1862, when William Senior began a partnership at Parkhead Forge, formerly owned by Robert Napier. By 1886, William Junior (later Lord Invernairn) was in charge of the business, which also had a steelworks and gun arsenal and was diversifying into armour plate production and plates for high pressure Scotch boilers. By 1899 he had also taken over Robert Napier's insolvent shipbuilding yard at Govan, which he continued to operate until the sale to Harland & Wolff, as well as expanding Parkhead production to include railway equipment, axles and wheels. Meanwhile, in 1900, Beardmore opened another naval construction yard at Dalmuir, to the west of John Brown's yard at Clydebank, which he developed extensively over the next 35 years, building cargo vessels and steamers for commercial owners and warships for the Royal Navy, including the world's first aircraft carrier, HMS *Argus*. By 1903, Beardmore had taken over the Arrol-Johnston automobile plant and, with Vickers, established the Electric Crane & Hoist Company, which he sold three years later. In 1905 he bought a steelworks. By 1906 he was building engines for aircraft and ships. The Beardmore yard at Govan was bought by Harland & Wolff in 1912. During World War I, Beardmore was making gas and oil engines and aircraft. After the War, he was making steel, cars, motorcycles, and boilers for locomotives. However, after 1920, all departments of the Beardmore

'empire' began to lose money. In 1928, after an external investigation, William Beardmore was ousted from his position and parts of the company were shut down. The company started to build trucks in 1930, and even built the engines for the airship R-101, the same year that more of its activities were terminated. The Dalmuir shipyard also closed in 1930 in response to the Depression-level market conditions. The remaining steel business was taken over by Sir James Lithgow. At his peak, Beardmore employed 40,000 people.

The partnership of G&J Weir was founded in Liverpool in 1870 by the brothers, George and James Weir. Initially inventors, designers and consultants rather than manufacturers, they moved into this activity in 1886, at the Holm Foundry in the Glasgow district of Cathcart. Their manufacturing centred on pumps, feed heaters, condensers, boilers and other auxiliary equipment for ships. They exhibited at Glasgow's International Exhibition in 1888. The partnership became a private limited company in 1895. William Weir, son of James (and later Viscount Weir) became chairman in 1912. Under his leadership, the company diversified into the manufacture of compressors, automobiles and aircraft engines and, during World War I, made armaments and munitions. The company, thanks to the diversity of its products, survived the Depression and World War II years, and the decline of Clyde shipbuilding. The Weir Group was formed in 1971. Its major product has been pumps that can be widely used in industry and elsewhere. It also remains a major Glasgow employer.

James Howden, the engineer, was the inventor of the Howden forced draft system that significantly reduced the amount of coal used in marine boilers. Born in the east of Scotland in 1832, he apprenticed with the James Gray engineering company in Glasgow. In 1854, he established a consulting practice and very shortly thereafter founded James Howden & Company to manufacture equipment for the shipbuilding industry. From 1857 he designed, as well as supplied, boilers and steam engines, and was also awarded patents for a variety of associated inventions. In 1898, when his original plant became too small, Howden opened a larger one at Scotland Street, which was centrally heated - unusual for the times. Early in the 1900s, Howden designed a high-speed steam engine for both marine and land use. He died in 1913, but his company continued to do, and expand on, what it had done under his leadership. Before it was closed in the 2000s, the Scotland Street plant - one of the last remaining Victorian heavy engineering works in Glasgow - was where the tunnel boring machines for the Channel Tunnel were made.

William Arrol was born in Renfrewshire. He established the Dalmarnock Iron Works in the east end of Glasgow in 1872, a year before the civil engineering firm that bears his knighted name, which was also headquartered in Glasgow. The Arrol engineering companies were perhaps best known for their part in building the Forth Bridge (completed in 1890). Their Clydeside projects included the Caledonian Railway Bridge over the Clyde at Bothwell (1878), the railway bridge for St. Enoch's Station in Glasgow (1900), the White Cart Bridge at Renfrew (1923), and the many *Titan* cranes around the world. The engineering companies continued in business until 1969, when they were sold Clarke Chapman.

David Rowan & Company made engines for builders of passenger and cargo ships who did not have their

own engine shops, for example, the Charles Connell Company. They also built boilers. Established in 1877, as a private company, their shops were on Elliott Street, Finnieston. In 1885, James Rowan joined his father and the company became David Rowan & Son. During World War I, they ran a shell factory. In 1917, they were taken over by Lithgows. In 1961 Rowans merged with Fairfields.

The association of Archibald Barr, who had returned to the Regius Chair of engineering at Glasgow University, and William Stroud, a professor of physics at what is now the University of Leeds, began in 1888. Their first product was a rangefinder, which was sold to the Admiralty in 1892 and manufactured by contractors. In 1893, Barr and Stroud formed a company. By 1904, they had 100 employees working in a new plant at Anniesland in the west of Glasgow. In 1909 and 1913, first Stroud and then Barr resigned from academia and a limited company was formed. They continued to design and make rangefinders, periscopes, binoculars and other instruments with military applications, as well as diversifying into those for civilian applications. Barr died in 1931. In 1940 the company moved into larger premises. It also opened London offices. In 1977, the company merged with Pilkington Ltd. In 1992, it moved its operations to Govan from Anniesland. In 2000, Barr & Stroud became Thales Optronics Ltd.

In 1868, John G. Kincaid, whose training was in marine engineering, and two partners bought the Clyde Foundry and Engine Works on East Hamilton Street in Greenock. At first, the company built steam engines and auxiliary equipment that went with them, some of which Kincaid invented. In 1873, one partner, Hastie, dropped out to start his own business and Kincaid and Donald moved farther into marine engineering. In 1882, Donald retired. In 1888, the firm became Kincaid & Company, with limited liability, and in 1895 John G. Kincaid & Company, with John and his brother Charles as partners. John's sons were to head the company until 1964. But back in 1912 the Clyde Foundry was expanded, and again in 1914, by which time it was making engines and boilers for a variety of steamers built at home and abroad and had over 400 employees. The company's positive response to wartime production pressures attracted Royal visitors to the plant. It expanded and modernized again in 1919, acquiring a new plant. In fact, constant modernization was an operating theme within the company. In 1922, Kincaid was given a sub-licence by Harland & Wolff to build and export B&W marine diesel engines. The first of these engines was completed in 1924. In 1937, John G. Kincaid became a public company. It had a 'good' World War II. In 1949 it opened an apprentice training school. In 1953 it built a large new plant on Arthur Street in Greenock, which included an electrically-powered smithy. However, the company continued to build steam engines for many years, delivering the last production one in 1954. But the very last one that Kincaid's built, in 1962, was a replica of the engine that had driven Bell's *Comet* in 1812. By 1961 it had 1,700 employees. In 1977, under government legislation, the company was acquired as a subsidiary of the British Shipbuilders Corporation (BSC) and the following year was merged with Clark-Hawthorn of Tyneside, which BSC later sold to HLD Holdings, which sold it in 1990 to Kvaerner Industries of Norway, becoming Kvaerner Kincaid, which was sold again in 1999 and stopped manufacturing.

Kincaid's partner, John Hastie, opened a small plant in Greenock in 1843 to make 'engineering products.' In 1853, he patented the first self-holding steering gear and went on to manufacture them. In 1870, this

company began making steam steering gears. In 1898 it became a public company, John Hastie & Co.. Prior to World War I, it had developed and manufactured electric-hydraulic steering gear, which remained its main activity in the long term. The company remained in business until 1972, when it was acquired jointly by the Weir Group and Lithgows Ltd.. It was dissolved in 1991.

The Eagle Foundry on Baker Street in Greenock was bought by Daniel Rankin and Edward Blackmore in 1862. It began making sugar machinery and branched out into boilers and steam engines for marine use. In 1874, Rankin himself invented a disconnecting compound engine for paddle and twin-screw steamers. His two sons developed several types of triple and quadruple expansion engines. By 1885, the sons were managing the business, which supplies engines for passenger and cargo paddle steamers and tugs. Thirty years later the company was manufacturing as many as 30 different types of engines. Its plant was heavily damaged during the 1941 German blitz. In 1952, the company became a subsidiary of Lithgows, who closed the foundry in 1954 and the company itself in 1964.

The North British Locomotive Company is being included here since its products were the principal reason for the building of the Finnieston (Stobcross) crane which, for many years, transferred locomotives from quayside to ships' holds on their way to foreign countries. Established as a public company in 1903, NB Loco had three plants in the Springburn and Polmadie districts of Glasgow. Over the years, it supplied thousands of locomotives for domestic and foreign markets. In some years, it built as many as 400. Most were steam-driven. A few of the later ones were diesel or electric. The company ceased trading in adverse business and technical circumstances in 1963.

The St. Rollox Works began locomotive production in the Springburn district in 1856, for the Caledonian Railway. For around 60 years, it was an unusual plant in that rolling stock was also built. In 1921 it became the main northern plant for the LMS Railway. Since 1929, however, it has been mainly concerned with overhauls and repairs.

Some Eminent Engineering and Shipbuilding People - before (and after) 1968

Greenock's - and Glasgow's - best-known engineering alumnus is likely to be James Watt, born in Greenock in 1736. His father was a shipwright and contractor. Watt made his early engineering reputation in Glasgow and in other places around Southern Scotland, and later as Matthew Boulton's partner in their famous steam engine-building enterprise in Birmingham. He died in 1819.

Charles Randolph was born in Stirling in 1809 and educated at Anderson's University/Institution. He apprenticed as a millwright with Robert Napier's cousin David, but came under Robert's influence. By 1834, he was a partner in Randolph, Elliott & Company, millwrights. John Elder joined them in 1852 and the firm became Randolph, Elder & Company, marine engineers, which made significant contributions to the development of compound steam engines. In 1856, the firm took over a shipyard in Govan, which later became the Fairfield Shipbuilding & Engineering Company. Randolph retired from business in 1868

but maintained his connection with the Clyde Navigation Trust. He died in 1878. Randolph Hall, in the main building of the University of Glasgow, was named after Charles, who had contributed to the completion of the Bute Hall, next door to it.

Quite a bit younger than Charles Randolph, John Elder was born in 1824 in Glasgow, the son of the inventive David Elder, Robert Napier's foreman. An apprentice under Robert, John Elder joined Randolph, Elliott & Company and remained with it until he died in 1869 at the age of 45, having contributed significantly to work on the compound steam engine. John's brother, Alexander, founded the Elder Dempster steamship line.

William John Macquorn Rankine was born in 1820 in Edinburgh, the son of an engineer. Educated in various Scottish cities, he studied at the University of Edinburgh from 1836 to 1838, after which he undertook a railway engineering pupillage under Sir John Macneill, at the same time making contributions to research in surveying. Then followed a variety of employments. In 1850 he was elected a Fellow of the Royal Society of Edinburgh and of London in 1853. In 1851 he moved to Glasgow and, in 1855, at the age of 35, was appointed to the Regius Chair of civil engineering and mechanics at the University. He made contributions to the thermodynamic and heat engine theory, including the Rankine cycle. He studied the application of engineering theories to practice, worked closely with shipbuilders, and made contributions to naval architecture and marine as well as civil engineering, including soil mechanics. He published several hundred scientific papers. He died in 1872 at the early age of 52.

Alexander Kirk was born in Barry, Angus, in 1830. In addition to his apprenticeship with Robert Napier, he attended the University of Edinburgh and worked briefly in London for the famous Henry Maudslay. During his subsequent career, he 'engineered' in several marine firms in Glasgow, contributing significantly to the design, development and engineering of steam engines. He also served a term as president of the IESIS (see below). Kirk died in 1892.

Pearce Lodge, on the Gilmorehill campus of the University of Glasgow, was named after William Pearce. This rare Englishman amid the Scottish shipbuilders was born in 1833 at Brompton in Kent. He apprenticed in naval architecture and as a shipwright at the Royal Navy's Chatham Dockyard. In 1863, after several years of further work at Chatham, in succession he joined Lloyd's Register of Shipping on the Clyde, became general manager of Robert Napier's company where he designed innovative ships, became a partner in John Elder & Company, and its sole owner in 1878. In 1886, the Elder Company was merged with the Fairfield Shipbuilding and Engineering Company, with Pearce as chairman. Meanwhile, he had taken an active interest in local and national politics, becoming the MP for Govan. In 1887 he was made a Baronet, but died in London a year later.

John Harvard Biles, another Englishman, was born at Portsmouth in 1854. He apprenticed at the Portsmouth Royal Navy Dockyard and graduated from the RN College, Greenwich, in 1875, when he took first place in naval architecture. For the next five years he worked for the Admiralty as a member of the Royal Corps of Naval Constructors. In 1880 he joined the Thomson Shipyard at Clydebank as chief designer and was involved in the design of such ships as the *City of Paris* and the first British torpedo-

boat destroyer. In 1891 he was appointed to the John Elder Chair of Naval Architecture at Glasgow University, held it for 30 years, but maintained a large consulting practice, which he continued after retiring from the University. He was a member of various government committees, as well as serving the Admiralty in its development of warships, and was also involved in the design and construction of merchant ships. His work was well known in the United States and Japan as well as in Great Britain. He was knighted in 1913 and died, in harness, in 1933.

The Denny family had built ships at Dumbarton since 1814. Maurice Edward Denny was a member of the fourth generation to do so. Born in 1886 at Dumbarton, educated in England, Switzerland and Germany, he graduated in naval architecture from MIT while undergoing a 'co-operative apprenticeship' with the family firm. He also worked for a year with the Doxford diesel manufacturing company. In 1911 he was made a partner, the same year he worked with C.A. Parsons to produce Denny's first geared turbine engines. He was involved in the development of a vane-wheel system for powering flat-bottomed river boats and collaborated in the production of the Denny-Brown ship stabilizer, which was first used in World War II. In 1920, he was elected vice-chairman of Denny's and, in 1922, chairman. In 1936 he succeeded his father as baronet. In his later years he was active in the Shipbuilding Employers' Federation and the predecessor of Lloyd's Register of Shipping. Maurice Denny was also closely associated with the work of the Institution of Engineers and Shipbuilders in Scotland (see below) and the Institution of Marine Engineers. He retired in 1952 and died three years later.

Eric Yarrow was born at Bearsden, Glasgow, in 1920, the only son of baronet Sir Harold Yarrow, and the heir to the Scotstoun-based Yarrow shipyard, which had a world-wide reputation for building fast naval vessels and for the manufacture of boilers for power generation. Educated at Glasgow University, with industrial training at the engineering firm of G&J Weir, Yarrow was commissioned in the Royal Engineers during World War II, served in Burma, and was decorated for his service. Postwar, he joined Yarrows in a management capacity, rising to chairman and inheriting his father's baronetcy in 1962, as shipbuilding on the Clyde was winding down. He served the company for 39 years, saving it - largely through the firm's long and successful connections to the Royal Navy and his own efforts, diplomacy and salesmanship. Today, Yarrow remains one of only two Upper Clyde firms still in the shipbuilding business, albeit as part of BAE Systems Ltd.. Eric Yarrow died in September 2018 at the age of 98.

Some Notable Ships - before 1968

Chris Jones notes that the output of 'iron' ships by the Clyde shipyards by 2010 was something like 22,000 vessels (although this may be an underestimate). Some of them were *notable*, and for a variety of reasons. Also, the building on the Clyde of such famous ships as the RMS Queen Mary, the two Queen Elizabeths, and the Lusitania is *well enough known* for them to be omitted from what follows...which are simply some notes on just a handful of other notable ships. The 1812 *Comet* has already been mentioned.

In 1835, Todd and McGregor launched the SS *Vale of Leven* from their Glasgow yard on the north side of the river. It was the first iron vessel built on the banks of the Clyde and launched directly into its waters.

When the iron-clad HMS *Black Prince* was launched from Robert Napier's shipyard in 1861, it was the largest ship that had by then been built on the Clyde. Propeller-driven, it was three-masted, had steam engines and 10 boilers, and served as a warship until 1899, when it was assigned to training. It was broken up in 1923, after a 60-year career.

The Hutcheson/McBrayne steamer PS *Iona*, two-funnelled and 255 feet long, was built and engined in 1864 by J&G Thomson. It served for 72 years, becoming the longest-serving of the Clyde steamers. It sailed between the Broomielaw and the Western Isles.

In 1870 the hull of the clipper ship *Cutty Sark* was built by Scott & Linton of Port Glasgow, but the company went bankrupt before finishing it. The hull was towed across the river to the Denny yard, at Dumbarton, where it was rigged for sailing.

The TSS *King Edward* was built in 1901 by William Denny & Brothers, Dumbarton, and named after King Edward VII. It was the world's first turbine-driven passenger steamer. This vessel operated on the waters of the Firth of Clyde for over 50 years.

The RMS *Empress of Britain* was built for Canadian Pacific Steamships by Fairfields in 1905-06, the first of three ships of the same name. Of 14,000 gross tons and 570 feet long, this ship was powered by two quadruple expansion steam engines and twin propellers and was one of the fastest transatlantic liners of the time, crossing the ocean regularly between 1906 and 1923, except during World War I. In 1912, just weeks after the *Titanic's* fatal collision with an iceberg, the *Empress* collided with one, but with minimal damage. She was renamed the SS *Mountroyal* in 1924, but continued as a passenger liner until scrapped in 1930. She was the sistership of the CP's RMS *Empress of Ireland* which sank tragically in the Gulf of St. Lawrence in 1914.

The SS *Keewatin* (3,856 tons gross) is a Canadian legend and currently a Canadian museum at Port McNicoll. Built by Fairfields in 1907, and owned by Canadian Pacific, the '*Kee*' sailed the Atlantic to Canada, was cut in half at Lévis to get her through the canals below Lake Erie that could not then handle a ship so long (337 feet), and was put back together again at Owen Sound. She carried passengers and freight for 60 years on the Great Lakes. Intended eventually for scrap, the '*Kee*' was saved by an American called Peterson who had her towed to Lake Kalamazoo, Michigan, where she became a museum for the next 45 years. In 2011, she was repurchased by Port McNicoll people and returned there triumphantly the following year, the last remaining Great Lakes passenger liner and the last Edwardian-built passenger steamship in the world. She had a 3,300 hp quadruple expansion engine and four Scotch boilers.

Launched in March 1916 from Fairfields yard in Govan, HMS *Renown* was the lead ship of her class of battle-cruisers and was one of the two fastest capital ships when completed (the other was HMS

Repulse). Almost 800 feet in length, a crew of 950, and driven by two steam turbine sets and four shafts, *Renown* did not see combat during World War I. Extensively refitted between the wars, she saw a great deal of it during World War II. She was scrapped at Faslane in 1948.

John Brown's yard built *Renown's* sistership, HMS *Repulse*, at Clydebank. Commissioned in 1916, she took part in the naval action at the Heligoland Bight in 1917. Also reconstructed twice between the wars, *Repulse* was sunk by Japanese air action in the Pacific in December 1941.

The battle-cruiser HMS *Hood* was launched on 22 August 1918, from John Brown's yard after two years of construction. For many years, the *Hood* was the largest warship in the Royal Navy. She was sunk in 1941 by the German raider *Bismark* with the loss of almost all her crew.

The construction of HMS *Vanguard* began towards the end of World War II, again at John Brown's yard, but was not completed until after the war ended. Planned as a Lion Class vessel, *Vanguard* was the last battleship to be built for the Royal Navy. Commissioned in 1946, she was selected to take the Royal Family to South Africa the following year. In 1955, she was placed in reserve and was scrapped in 1960.

The second PS *Waverley* (the first one was sunk at Dunkirk in 1940) was designed and built at the A&J Inglis shipyard at Pointhouse and launched in 1947. Steel-hulled, two-funnelled, 250 feet long with a beam of 58 feet, her diagonal triple expansion engine was made by Rankin & Blackmore of Greenock. This vessel served on the Firth of Clyde for her railway masters until 1975. She then changed ownership and began a career as a tourist vessel, cruising round the British Isles and becoming the world's last sea-going paddle steamer. A major restoration was carried out in 2003.

The second ship to be called *Melbourne Star*...this vessel was also one of the largest - at 13,000 tons gross - to be completed by Harland & Wolff's Govan yard after World War II, in 1948. This 'reefer' ship was powered by two eight-cylinder double-acting, two-stroke diesels, which had been built in the H&W's Lancefield Street engine plant. Her original owner was the Blue Star Line. In 1972, she was sold and registered in Greece, and sold again for scrap in 1973. More about her later.

HMY *Britannia* served as the Royal Yacht from 1954 until 1997, when she was retired and permanently berthed on display at Leith on the Firth of Forth. Built by John Brown at Clydebank, she was designed for rapid conversion to a hospital ship in time of war and, in the event of a nuclear war, to provide refuge at sea for the Queen and the Duke of Edinburgh.

Specifically, about Glasgow - pre-1968

From its beginnings as a small rural settlement, Glasgow was the centre of the Scottish Enlightenment, grew to be the second city of the British Empire, and was Scotland's largest seaport.

In Glasgow, the port area was several miles long, downstream from the Broomielaw and until the end of

the shipbuilding period both sides of the river were lined with quays and sheds/warehouses at which vessels docked to load or unload. In addition to the yards and their fitting-out basins, there were graving docks and drydocks, some dating from the late 19th century, some owned by the Clyde Navigation Trust (CNT), others by the shipbuilders. The CNT also owned and operated a fleet of dredgers, hopper barges and tugs. Clipper-type sailing ships could be seen on the Clyde until just before World War I. They were employed on the long Australia-Britain sea route, carrying wool one way and manufactured goods in the other.

The Depression years reduced the volume of trade and the numbers of vessels using the port of Glasgow. World War II changed this significantly. But eventually, facing increased competition from abroad, the railways, a growing number of motorways and jet aircraft - plus bigger ships and, eventually, containers - business at these docks diminished in the post-shipbuilding years and Glasgow, as a port city, began to fade. The city's 'date of change' may also be considered to be 1968.

The modern city of Glasgow has always had a well-developed engineering-based land transportation system. The streetcar (tramway) system began operations in 1872, and was electrified by 1898. It grew to be one of the longest urban systems in Europe, with over 100 route miles and 1000 double-decker cars in service. The Airdrie and Paisley systems were incorporated into the Glasgow one in the 1920s. Perhaps the most famous Glasgow streetcars were the double-decker *Coronations*, brought into service in 1938 and visible for many years after that. The system was closed down in 1962 in favour of diesel buses.

Glasgow still has two mainline railway stations: Central and Queen Street. Two others, St. Enoch and Buchanan Street, were phased out in the 1960s and St. Enoch demolished.

Glasgow's subway follows a circular route around the centre of the city. It is all underground. It was opened in 1896 and twice modernized, but has never been expanded.

Among the city's distinguished older buildings are: Glasgow Cathedral (12th century); the Britannia Panopticon Hall (world's oldest surviving music hall) (1857); the George Gilbert Scott buildings on the University of Glasgow's main campus (1870); the Mitchell Library (1877); the City Chambers (1888); the Peoples' Palace (1898); the Victoria Infirmary (1890); the Kelvingrove Art Galleries and Museum (1901); the Charles Rennie MacIntosh College of Art (1909), recently destroyed by fire; and the main building of the University of Strathclyde (1912).

Of special interest is the large, six-acre Kelvin Hall, the second such hall, opened in 1927, the first one having been destroyed by fire. It has an impressive red sandstone front and a steel frame structure and was used initially as an exhibition venue and to complement the nearby Kelvingrove Art Galleries and Museum. The Hall has also housed major concerts, motor shows, industrial, trade and other large conferences, sporting events, rock concerts, circuses and carnivals, and religious rallies. The Glasgow Museum of Transport was housed there between 1987 and 2010. While the new Scottish Exhibition and Conference Centre at Queen's Dock has taken over many of the Hall's functions, the Kelvin Hall's

facilities have been redeveloped and its activities are now organized by a partnership that includes Glasgow's City Council, Glasgow Life, the University of Glasgow (whose main campus is also nearby) and the National Library of Scotland.

Speaking of buildings...for a very long time, Glasgow gained notoriety for its over-crowded and run-down housing areas (slums) where living was hard, in districts like the Gorbals, Maryhill, Bridgeton, Gallowgate and Pollockshaws. After 1935, to relieve this situation, Glasgow's Corporation began building housing estates on the city's fringes, in places such as Mosspark, Riddrie, Knightswood, Castlemilk and Drumchapel. This rebuilding continued after World War II. Old buildings in the Gorbals and elsewhere were demolished. New areas were opened, some with high-rise buildings. Unfortunately, the high-rises were not all well built and some have, themselves, been torn down and the tenants rehoused elsewhere. Also, several 'new towns' have been developed outside the city, such as East Kilbride and Cumbernauld.

As noted above, the most damaging German attacks on the Glasgow area during World War II were the air raids centred on Clydebank on March 13 and 14, 1941. (Through my bedroom window, I watched the low-flying German bombers make their way to Glasgow, and then home again. This was the closest I ever came to any German servicemen during the War. Also, someone gave me the tail end of an incendiary bomb unused on the Clyde and dropped by a German plane on our nearby Pentland Hills on its way home.)

Some Clydeside horn-blowing

Glasgow, Clydeside and Scotland could, and did, blow their horns about what they have and have had, and what they have accomplished. For example...

At its peak, in the years before World War I, there were 38 shipyards in operation on Clydeside. They built one-quarter of all the world's new ships and employed 100,000 people.

During the two World Wars, the Firth of Clyde was the main entry point to Britain from the sea.

Long before then...the University of Glasgow was established almost 600 years ago, in 1451. Its connection with engineering and shipbuilding goes back a long way too. In the late 1700s, for example, it employed James Watt.

In 1840, it had the distinction of having the very first Regius Chair in Civil Engineering and Mechanics in Britain. The first occupant was Professor Lewis Gordon, who was closely associated professionally with the development of Glasgow's main water supply from Loch Katrine. He was followed by W.J. Macquorn Rankine who, as noted above, made major contributions to engineering theory and practice. His book, *A Manual of Civil Engineering*, published in 1871, is almost 800 pages long. (The copy I have

was owned originally by Casimir Gzowski.)

Glasgow University moved from downtown to its present main campus on Gilmorehill in 1870, where the central Gothic Revival building bears a striking resemblance to the Centre Block of the Parliament Buildings in Ottawa.

In 1872 a Chair in Naval Architecture was endowed by the family of shipbuilder John Elder, in his memory. Ocean engineering was added to its title after World War II. In 1872, also, the degree of B.Sc in Engineering was first awarded. In 1901 the new engineering building and laboratories at the University were named after James Watt. However, a Faculty of Engineering was not established until 1923. In 1941 Chairs, again named after James Watt, were established by the Institution of Engineers and Shipbuilders in Scotland in Electrical Engineering and the Theory and Practice of Heat Engines, which were later changed to Electrical and Electronic and Mechanical Engineering. The Mechan Chair in Aeronautics and Fluid Mechanics was established in 1951. (Chemical and Mining Engineering have only been taught at the Royal Technical College, later the University of Strathclyde.) In 1970 the Faculty's Rankine Building was opened. In 2001, the Naval Architecture and Marine Engineering Departments at the Universities of Glasgow and Strathclyde became jointly owned. The name, School of Engineering, at Glasgow, dates from 2010. It is part of the College of Science and Engineering.

The University of Strathclyde's association with engineering goes back to 1828, to the founding of Anderson's Institution (or University). In 1887 it became the Glasgow and West of Scotland Technical College. In 1912 it was renamed the Royal Technical College and the distinguished main building of its downtown John Anderson Campus was completed. In 1956, the 'Tech' became the Royal College of Science and Technology (RCST). For most of this College's life, it had been concerned with the training of technologists and technicians and with providing night classes for working apprentices and technicians. It has also had close links with industry. In 1964 the RCST became the University of Strathclyde. In 1993, Strathclyde took over and operated a second campus at the former teacher training college at Jordanhill. In 2012, this unit was moved downtown to the main Anderson Campus. Between 1913 and 1964, engineering and applied science students at 'Tech' were eligible to write University of Glasgow exams and receive its degrees. Strathclyde's Engineering Faculty currently includes eight departments: architecture; biomedical; chemical and process; civil and environmental; design, manufacturing and engineering management; electrical and electronic; mechanical and aerospace; and naval architecture and marine engineering.

The Institution of Engineers in Scotland was founded in 1857 in Glasgow as a 'learned' engineering society. It was amalgamated in 1865 with a 'learned' shipbuilding one, and became the IESIS. The first Institution president was Professor W.J. Macquorn Rankine and, in the years since then, many of Glasgow's shipbuilding leaders and engineering professors have occupied the chair. In 2011, IESIS initiated the founding of the Scottish Engineering Hall of Fame. Of the 31 inductees to date, six have been mentioned in this paper: James Watt, John Elder, Robert Napier, Macquorn Rankine, William Arrol, and William Weir. At least ten others have Clydeside connections.

There have also been a number of exhibitions that have highlighted Glasgow's, Clydeside's and Scotland's culture and industries.

The first major one was the International Exhibition of 1888, the buildings for which were in Glasgow's Kelvingrove Park. It drew attention to achievements in science, industry and art...and raised money for future cultural buildings in the city. The second was the International Exhibition of 1901 which celebrated the city's industrial, scientific and artistic progress during the 19th century, again in Kelvingrove Park. It featured the permanent new Art Gallery and Museum building and another very large temporary one. The third was the International Exhibition of 1911, again at Kelvingrove Park, but in temporary buildings. Interestingly, the profits from this Exhibition were used to establish the Chair of Scottish History and Literature at Glasgow University. And the fourth was the Empire Exhibition at Bellahouston Park in 1938. It featured a strong Scottish contribution, and included the 300-foot-high Tait's Tower, with galleries up top for viewing the city. The tower was intended to remain in place permanently, but was demolished when the war began in 1939 since it could help guide German bombers to Clydeside targets.

Finally, the British government, in response to employment problems stemming from the Depression and the needs of prewar rearmament, established an industrial park at Hillington in Glasgow in 1934. By 1938, 84 factories had been let, and while only a few had relevance to shipbuilding, they helped alleviate the unemployment problem generated in part by the lack of ship orders.

Post-Shipbuilding History - 1968 and after

The Clyde shipyards were busy during the first dozen years immediately following World War II. Their subsequent decline over the next decade may be associated with a handful of factors:

...the government subsidies to ship-owners to replace tonnages sunk during the war had been used up by 1950, and orders for large new warships had become fewer;

...some Clyde shipbuilders were reluctant to modernize their yards, form larger production units, and invest significantly in new plant, equipment and technology; those that did invest often chose inappropriate new technology (technically speaking, their main concern was the substitution of welding for riveting in hull construction);

...countries and companies in Europe and the Far East decimated by war or not involved in it were building or rebuilding from scratch with new equipment and engineering; many of these rebuilt and new shipbuilding activities also enjoyed generous government support, tax breaks, relatively low wage rates, high levels of productivity, and faster and more accurate production times;

...the size of passenger/cruise ships, bulk carriers and supertankers was growing beyond the capacity of the pre-1968 Clyde yards to build and launch them, except possibly John Brown's, Fairfields and the yards on the Lower Clyde estuary;

...more goods were travelling by road, using ferries to cross waterways, and many more people and much more freight were travelling by air in the new jet aircraft; and

...productivity (in spite of high wage rates) and labour relations in the shipyards were sub-par, and prices generally were rising.

Essentially, by the late 1960s, the Clyde yards had become uneconomic, physically unsuitable, often questionably managed, and too fragmented company-wise to compete.

(Even as an apprentice on Clydeside in the late 1940s, I could sense a slowing up of the business of shipbuilding then and the possibility that significant change could take place later. This feeling was sufficiently strong that I chose not to remain with Harland & Wolff, in Glasgow or in Belfast, or in marine engineering.)

So despite a reasonably good *worldwide* market for ships, by 1968 Clyde yards had closed or were closing for one reason or another, or were in financial difficulties. Harland & Wolff, for example, closed down its Glasgow shipbuilding operations in 1962, and even Fairfields was temporarily placed in receivership in 1965. Browns had not been able to complete the *Queen Elizabeth II* without significant government support. Only the Yarrow yard was operating profitably, thanks to its association with the Admiralty and the less trade-cycle restricted construction of small warships, and to the quality of its management.

In 1965, to help solve the shipbuilding industry's competitiveness problem, which, incidentally was *not* confined to Clydeside, the government commissioned what became known as the Geddes Report. The following year, it recommended amalgamations overseen by consortia on a regional basis. So in 1968, the government created the Upper Clyde Shipbuilders (UCS) consortium that amalgamated the Fairfield, Stephen, Connell and John Brown yards, with Yarrow as an associate member - employing 8,500 people, a small fraction of the tens of thousands the yards had employed during Clydeside shipbuilding's heyday. But in 1971, UCS went into receivership and was threatened with closure...which led to the famous Fairfield 'work-in' promoted by labour leader Jimmy Reid. The company was saved, as was Yarrow's, and became Govan Shipbuilders. Stephens was closed. The last John Brown ship was launched in 1972. The yard was sold to Marathon Oil, which built oil rigs there until closing the yard in 2001.

In 1977, Govan Shipbuilders was nationalized as part of British Shipbuilders, as did the Barclay Curle repair yard at Elerslie, which had become part of Yarrow's in 1974. Connells, by then a subsidiary of Govan Shipbuilders, closed in 1980. The Govan arrangement lasted until 1988. The Fairfield yard was then sold to the Norwegian Kvaerner Group and was modernized with a view to building LNG and chemical tankers. But by 1999, it had passed into the hands of BAE Systems and, along with Yarrow's,

was building warships for the Royal Navy, which both still do as parts of BAE Systems Surface Ships.

Farther downriver, at Inverclyde in 1968, as a result of the Geddes Report, the Scott-Lithgow Group was set up, with two operating companies, but two years later they were fully merged. In the 1970s, a new superyard came into being with the merging of their Glen/East and Kingston yards. This enabled the building of very large crude oil tankers and large bulk carriers. In the 1970s, also, the Scott part of Scott-Lithgow was still making tankers and ships for the Royal Navy. Scott-Lithgow was nationalized in 1977, becoming part of British Shipbuilders, but almost immediately ran out of orders. The last Scott ship was launched in February 1980. For a while, Lithgow turned to building oil rigs. In 1984, the yards were sold to Trafalgar House. Four years later they were demolished and the area redeveloped. Lithgows moved out of Clyde shipbuilding altogether and into other businesses.

The Scott yard at Bowling, which was taken over by Scotts of Greenock in 1965, joined the Scott-Lithgow Group in 1970. It was closed down in 1979. Between 1851 and then, it had built some 450 ships.

The Ardrossan Shipbuilding Company was closed in 1968.

In 1978 the Ailsa yard at Troon became part of the British Shipbuilders. In 1981, its assets and those of Ferguson Brothers were merged as Ferguson-Ailsa. In 1986, the Troon yard was sold and the Port Glasgow one became part of Appledore Ferguson Shipbuilders. The Ailsa component stopped building ships in 1988 and the company eventually closed down. In 1989 the Ferguson component was sold again, to Clark Kincaid of Greenock, which was later taken over by the Kvaerner Group, who sold it to a new local company, Ferguson Marine plc, which gave way to management by Holland House. Now known as Ferguson Marine and Engineering Limited, it was almost closed in 2014, but was rescued by Jim McColl of Clyde Blowers Capital.

A word about him and about Clyde Blowers. The company was incorporated privately in 1934 to make soot blowers for boiler plants, at Clydebank. By 1959 it was a public company and still making and selling soot blowers. In 1992, McColl, who had been with the Weir Group, purchased 30% of its equity and began making other acquisitions. In 1999, he bought the rest of the equity and took the company private. In 2007, he bought Weir Pumps from the Weir Group, and renamed it Clyde Pumps and proceeded to acquire other engineering firms and diversify his holdings further.

So between them, in 2017, the two BAE yards on the Upper Clyde and Ferguson's on the Lower Clyde were employing something like 3000 people. Tourism on Clydeside, on the other hand, was employing something like 30,000.

The coal industry in Scotland was nationalized in 1947. By the 1980s, the demise of the deep-mining industry in Lanarkshire and elsewhere was well under way as a result of exhausted seams, decreasing industrial demand, unrest in the industry itself, and competition from the increasing use of gas, electric and oil heating systems for buildings, although some open pit mining continued for a time in Lanarkshire and Ayrshire.

From prosperity in the 1960s, the market then began to disappear for the Clydebridge steel plant. It rolled its last plate in 1982. However, the heat treatment plant survived as a satellite operation of the Dalzell plant.

Between 1962 and 1992, the market for Ravenscraig's output declined steadily. It closed only three years after the 1988 privatization, responding to the downturn in shipbuilding, and was demolished four years later. In its heyday, it was the largest hot-strip mill in Europe...that became one of the largest derelict sites in Western Europe. In 2007, the Tata Company bought the Dalzell plant and what was left of Clydebridge but, in 2015, decided to mothball them. However, these plants were bought by the Liberty Group in 2016 and have since been reopened with assistance from the Scottish government.

Some recent initiatives

The Lower Clyde/Firth area now has a Scottish Maritime Museum. This Museum has had three locations. The first, still open, is in a building at the harbour of the town of Irvine on the Ayrshire coast. It is the rebuilt engine shop from the closed Alexander Stephen shipyard, salvaged in 1991. The exhibits include several very old vessels and some marine engines and machine tools. The second, also still open, has the Denny towing tank and is housed in its location at Dumbarton. The company originally sold the tank to Vickers, who sold it to the Museum, which opened it as an exhibit in 1982. The third location, opened in 1999 but closed in 2010, was at Braehead on the south bank of the Clyde and included exhibits about the river and shipbuilding from 1700 to 2000.

Hunterston, on the Ayrshire coast near West Kilbride and south of Largs, has been the location of two nuclear power plants supplied by the General Electric Company. *Hunterston A* was opened in 1964. It had two magnox reactors, each rated at 180 MWe, used natural uranium fuel, and had eight boilers. There were six 60MW Parsons steam turbine generators. This reactor was unique in that it had a refuelling system that was assisted by gravity. It was decommissioned in 1990. *Hunterston B*, opened in 1976, also has two magnox reactors, supplied by The Nuclear Power Group, each rated at 610 MWe, and Parsons turbines. It is scheduled to operate until 2023.

In the later days of its prosperity *as a port*, local resources were unable to satisfy all of the basic raw material needs of the industries along Clydeside. So until the late 1970s, bulk cargoes such as coal and iron ore arrived at the General Terminus Quay on the Clyde at Glasgow, not far from the Broomielaw, where facilities to handle the rail connections to their ultimate destinations existed. But by that time, the bulk carrier ships that brought them were growing to a size that the river and the quay could no longer handle. So a new sea terminal, with enough space and deep water for two large ships, was built at Hunterston, with gantry cranes and conveyors, and opened in 1979 with rail connections to Glasgow and elsewhere. At first, the principal bulk cargo arriving at Hunterston was iron ore headed for the Colville plant at Ravenscraig. But when this plant closed in the 1990s, along with the significant reduction in Scottish coal mining, the ore was replaced by coal. Some of the coal was reloaded into

smaller ships for delivery to other British ports. With the Hunterston development, the General Terminus Quay was shut down and its facilities demolished.

Bulk oil shipments to the Clyde now arrive at the Finnart Oil Terminal on Loch Long. Smaller container ships and cruise ships can still call at Greenock's Ocean Terminal.

Glasgow - post 1968

Historically, it seems that Glasgow as a city has always been struggling with recurring unemployment and permanent poverty, most recently during the city's transition from a manufacturing to a service economy. The 2008-2009 world financial crisis was not kind to Glasgow's employment levels.

Essentially, the basics of life and work in Glasgow have changed since 1968, from dependence on shipbuilding and heavy engineering to the exploitation of financial services, tourism and high technology. Some of its streets have been converted into motorways, changing areas like Charing Cross significantly. Trains have given way to trucks and cars, and some well-known stations have been demolished. The streetcar system was abandoned. The subway has been remodelled twice, but its circular route remains unchanged. Slums have been cleared and high-rise and other buildings in various parts of the city have replaced them. But while new housing schemes were used to re-house people from the slums, some preferred to migrate to the new towns, peripheral to the city, that were expanded to accommodate both high technology companies and organizations and people's homes.

Docks, yards, quays, sheds and warehouses along the river have also been closed, demolished or changed, especially for that part of the river several miles to the west of the Broomielaw. High-rises, housing units and other buildings have been put up on cleared and filled-in land. But the Finnieston crane has been left in place as a symbol of another era and a reminder of what it used to do.

It took a lot of Glasgow companies a while to realize that times, demand and technology had changed. Eventually, competition from the growing oil industry in the northeast of Scotland disrupted the Glasgow market for skilled workers. But Glasgow's lighter, lower-tech industries, such as carpets and textiles, also suffered from the shrinkage in a significant part of their previous customer base: the Clyde's newly built ships. And new high-tech companies seemed to prefer to locate in the new towns rather than in the city. As noted above, engineering companies such as North British Locomotive failed *before* 1968. The Parkhead Forge, famously associated historically with Robert Napier and William Beardmore, was closed in 1978. Glasgow has not yet solved all of its new market problems.

To combat changes to the River Clyde region that were triggered by the closing of the shipyards, docks and quays, the various governing bodies of the Region formed Clyde Waterfront Regeneration to transform the river's banks, from Glasgow Green to Dumbarton, by means of urban renewal projects involving housing, tourism and infrastructure. A Regeneration Group has coordinated and promoted this work. As you can imagine, considerable effort and expense has already gone into it. For example, high-

rise residential buildings now proliferate along the river. On the site of the former Queen's Dock, is the Scottish Event Campus. It includes the Scottish Exhibition and Conference Centre (SECC), which opened in 1984, and its annex, the Clyde Auditorium, with seats for 3,000, and now known as the SEC Armadillo because of its appearance, which followed in 2000. Their new neighbour is the SSE Hydro Building, opened in 2013, whose auditorium can seat 12,000.

Across the river, where Prince's Dock has given way to Pacific Quay and the Canting Basin, a series of structures with scientific connections has been assembled. The Glasgow Science Centre is a crescent-shaped structure that houses a three-floored Science Mall with interactive exhibits that include a planetarium. It opened in 2001. Next to the Mall is a 370-seat IMAX cinema that opened in 2000. A third structure is the Glasgow Tower, which has had a chequered career so far. Over 400 feet high, it effectively replaces the long-gone Tait's Tower at the Empire Exhibition of 1938 as the place to go for a panoramic view of Glasgow and its surrounding countryside. Aerofoil-shaped, it can rotate through 360 degrees, but the thrust bearing that makes this possible has been the principal source of the Tower's engineering problems. Another has been the elevator system. First opened in 2001, the Tower's several closures since then have lasted years. In November 2016, the TSS *Queen Mary II* was permanently berthed on the river at Pacific Quay, to be refurbished and become an exhibit associated with the Science Centre. Pacific Quay also includes the new headquarters for BBC Scotland and Scottish Television.

The Riverside Museum is at Pointhouse Quay, on the site of the former A&J Inglis shipyard, where the River Kelvin joins the Clyde. It is now the principal transport museum in Glasgow. Originally, this had been housed at Pollockshields, following the closure of Glasgow's streetcar (tramway) system. Moved to the Kelvin Hall in 1987, it came to the Riverside Museum in 2016. Exhibits include locomotives, automobiles, buses and streetcars.

More bridges have also been built across the river, beginning with the elevated Kingston Bridge in 1970, just west of the Broomielaw, and part of the Glasgow's proposed Inner Ring Road. It consists of two parallel cantilever spans, each with a five-lane deck. It has since been extensively refurbished to cope with the increased volume of traffic it has had to carry. In 2006, the Clyde Arc or 'Squinty' Bridge was built downstream of the Kingston Bridge to help carry this some of this high volume of traffic. It has a dual two-lane carriageway.

The Glasgow Garden Festival was held in 1988 on reclaimed land where Prince's Dock used to be. Bell's Bridge, for pedestrians and cyclists, was built across the Clyde to link the Festival with the SECC. It was refurbished recently. It was designed to swing open to allow ships to pass. The Millennium pedestrian bridge was built across the river to link the SECC on the north bank with Pacific Quay and the Glasgow Science Centre and opened in 2002. A third footbridge, at Tradeston, known as the 'Squiggly' Bridge, links Anderston on the north bank with Tradeston on the south bank and was opened in 2009. The original pedestrian Polmadie Bridge was built in 1955 to connect Glasgow Green on the north bank with Otlands on the south. It was closed 2015. A new bridge was opened in 2018.

In 1971, the chain-driven ferry downriver from Glasgow, at Erskine and east of the Bowling Bend, was replaced by a large, multi-span, cable-stayed, box girder bridge over the River Clyde, high enough to allow shipping to pass under it, and joining motorways in Renfrewshire and Old Kilpatrick, Dumbartonshire. It was built to help divert traffic from the Glasgow metropolitan area and provide access to Loch Lomond from the south and Glasgow airport from the north. It is now the most downstream of all the Clyde bridges. It began life as a toll bridge, until 2006.

In 2014, Glasgow played host to the Commonwealth Games, with the attendant construction of facilities within the city and on reclaimed dockland, for athletic facilities.

Personal...without parentheses

A few personal comments have already been made above (in parentheses). As mentioned in the **Preamble**, my family had connections with *Clydeside* many years ago. More recently, in the 1920s, my maternal grandfather was a farmer and contractor in the Hamilton area. He was a man with two main passions, at both of which he excelled: curling, and judging Clydesdale horses, in both of which he was recognized internationally. Later, the family retired to Largs, on the Ayrshire side of the Firth. As a youngster, I spent holidays there that included many happy hours sitting on a bollard on the pier watching steamers and other craft on the water, and sailing in a few of them. I remember both paddlers and turbines: for example, the first *Waverley*, which was lost at Dunkirk in World War II, the *Jeanie Deans*, the *Glen Sannox*, the *Mercury*, the *King Edward* and the first *Queen Mary*.

My connection with *Glasgow* as a city and a place to live began in 1945 when I first went to the University to study engineering and to undertake what might be called a 'co-operative apprenticeship' in the marine variety at the Finnieston diesel engine plant of the shipbuilders, Harland & Wolff. It ended when I completed a second degree at the University in 1954. While an engineering undergraduate, I belonged to the University's Engineering Society. Two of its memorable lectures I heard were by Sir Alexander Murray Stephen, then chairman of Stephens, and Charles Oakley, who wrote one of the principal sources for this paper.

At Finnieston, Harlands built large bore, slow and medium speed marine diesels under licence from Burmeister & Wain in Denmark. I worked in two of its engine shops and the drawing office on Lancefield Street, just 'down the street' from what had been the location of David and Robert Napier's Lancefield shops and on the next street to the Rowan shops, a hundred yards or so from the Finnieston crane and the river, and almost next door to Queen's Dock. The Harland shipyard was a short streetcar ride downstream, on the south side of the river.

My working connections aboard *Clydebuilt* ships were limited to the summers of 1948 and 1949, when I was a member of the test squad that made the engine room measurements for Harland-built ships on the measured miles of the Firth of Clyde and elsewhere. Most of the engines were diesels, built in the

H&W shops on Lancefield Street for tankers and cargo ships. The others were triple-expansion steam engines installed in whale-catchers' hulls, built at the H&W subsidiary, A&J Inglis Ltd., and mentioned above. None of these ships took more than a few minutes to cover the miles, so the measurement people had to hustle. In 1948, I was assigned to take the temperature and pressure measurements throughout the engine-room. In 1949, I took cylinder indicator cards, a rather more dangerous job that involved dodging large rocker arms in motion.

On our regular test trips during the summer of 1949, the test squad usually boarded at nearby Queen's Dock, where the vessel had been fitted out, or at the Harland yard in Govan, and sailed 'doon the watter.' As a result, week-by-week over several months, we would be on deck going down the river, taking note of progress being made in the building of the ships on the slips or, after launching, in their fitting out basins.

I was especially proud of my first and biggest ship, the Blue Star Line's 'reefer' - the MV *Melbourne Star*. As I have noted above, this ship went on to serve for about 25 years before being sold and broken up.

In Conclusion

I have given you only the bare essentials of the Clydeside story, and it has been centred on the river, shipbuilding and marine engineering, and the city of Glasgow. There have been, essentially, three phases to it. In the first, the river and the cities and towns on its banks were relatively undeveloped and their industrial activities were climate-dependent. In the second, the manufacturing of ships dominated, supported by other industries, some of which exploited the natural resources found nearby, and some provided a variety of engineered products. In the third, and most recent, the dominant element has been forced re-employment and industrial changes, with much reconstruction and new-building. It appears that Clydeside has managed to reinvent itself.

The reader should also be reminded that, today, 'weegies' no longer go 'doon the watter' from the Broomielaw each summer in steamers in large numbers. This service has not yet disappeared, although it almost has. The PS *Waverley* still makes the trip, from the quay beside the Science Centre to the Firth, travelling past silent or empty spaces where shipyards used to be. This quay is also the vessel's winter home. However, in 2019, it won't be going anywhere. It has serious boiler problems.

What I have discussed has had a lot to do with enterprise, innovation, growth, change...and unhappy endings, modified to some degree by more enterprise, innovation, change, and hopefully with happier results in the future. *Clydeside* will still be around and, hopefully, *Clydebuilt* will be too.

xxxxxx

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Principal Sources

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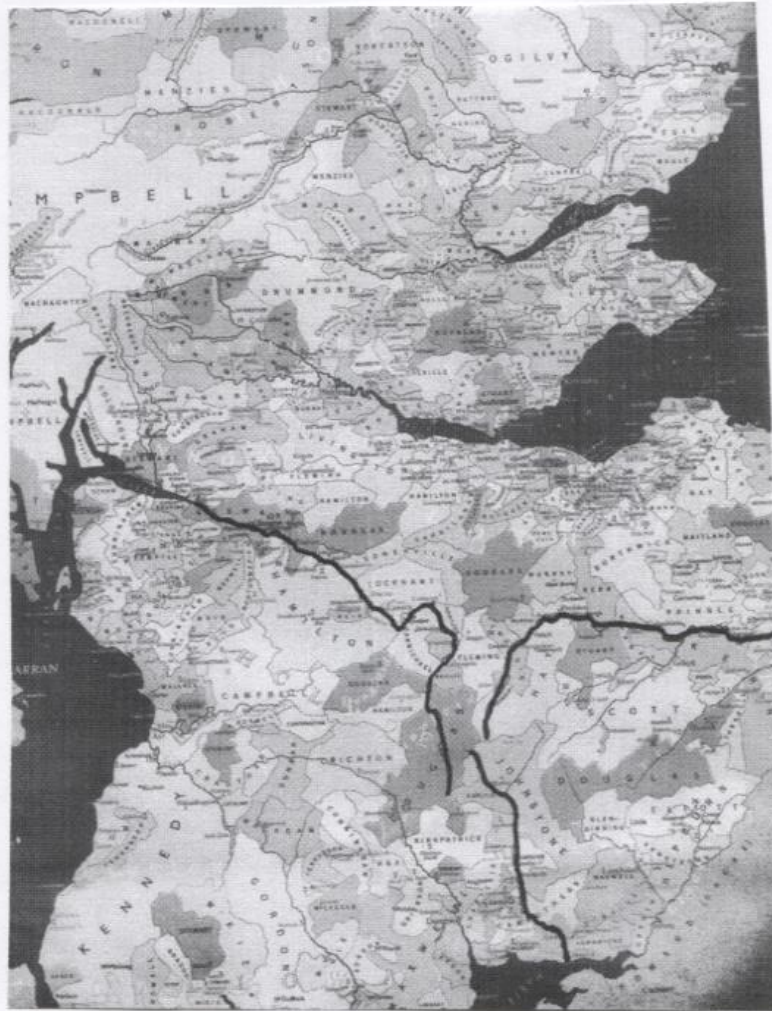
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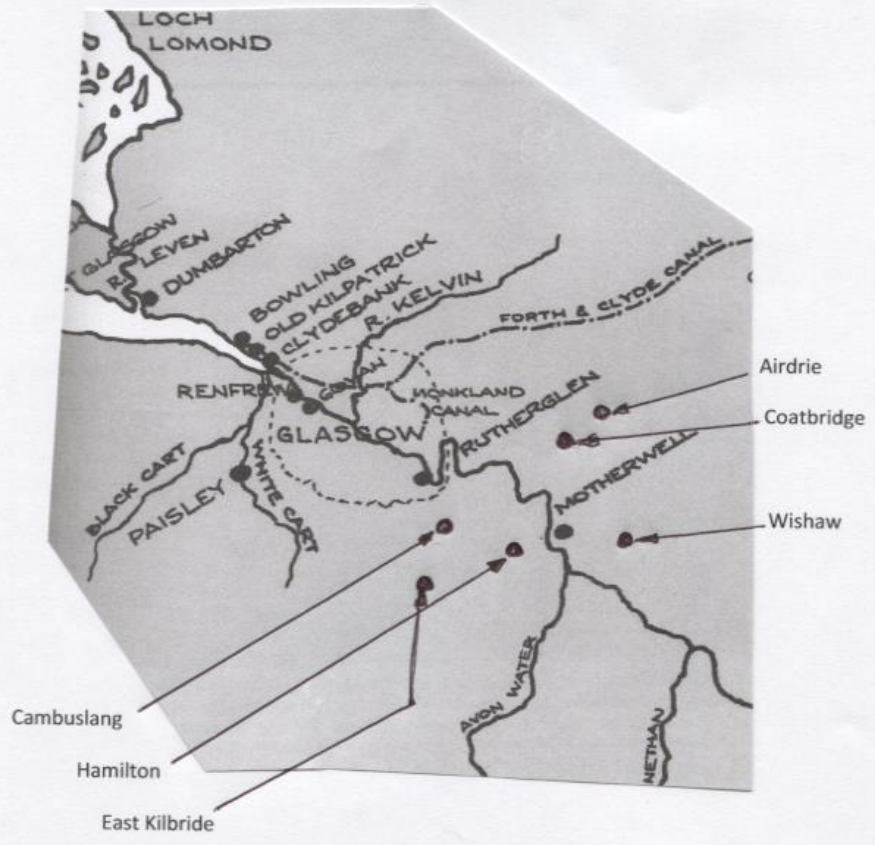
Illustrations

A number of maps, diagrams and photographs appear on the following pages. Each page has captions for its contents, with the exceptions of pages

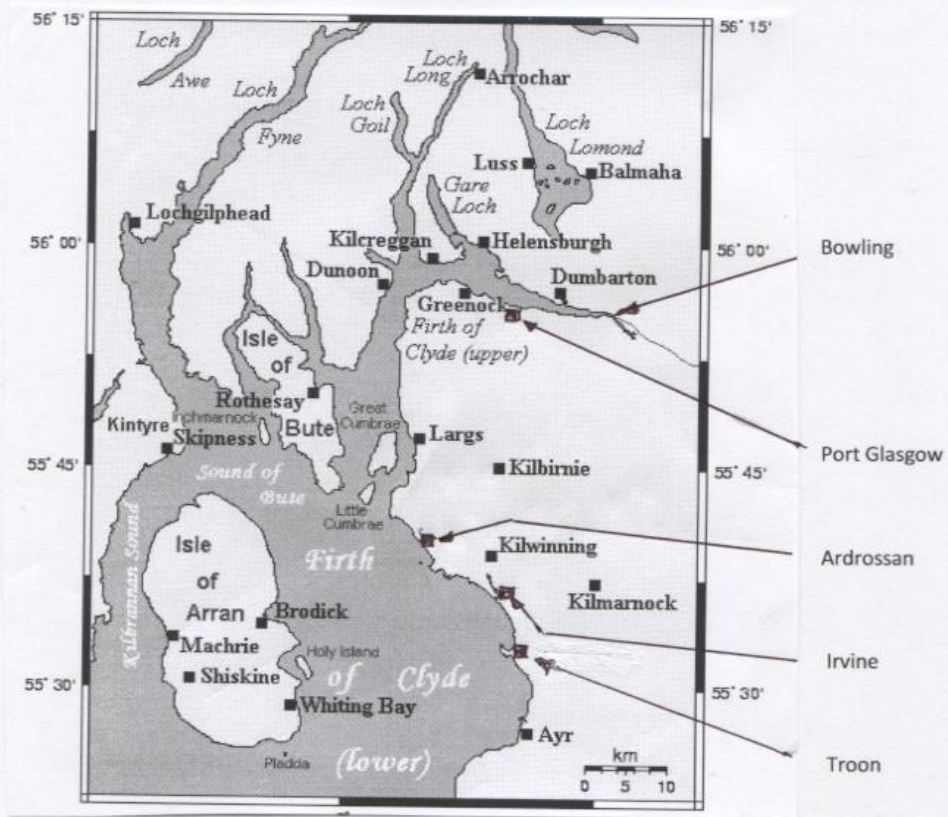


Southern Scotland -

Highlighting the Rivers Clyde (left), Tweed (right) and Annan (bottom)



Clydeside Towns



Firth and Estuary of the River Clyde

