

National Semiconductors and its First Wafer Fabrication Area in Greenock

By

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This is a look back at the building of the first Wafer Fabrication area at National Semiconductors in Greenock in 1971. It was the coming of an American company to Greenock with a brand new revolutionary technology which was embraced wholeheartedly by the womenfolk of Inverclyde. This look back is more about the people who started up the process plant rather than the technical difficulties, although there were a more than a few.

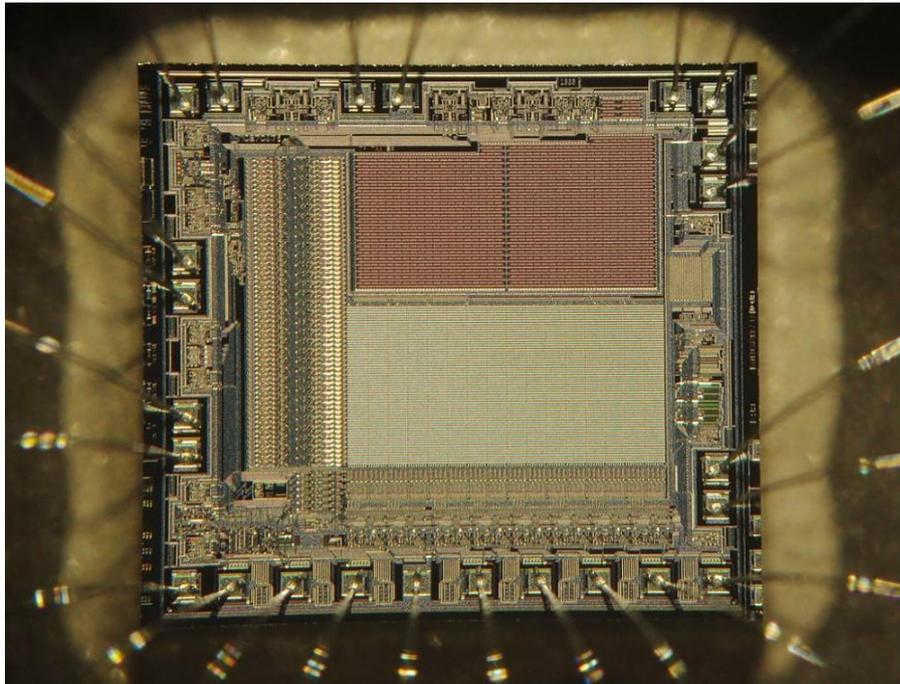


National Watch 1

National Semiconductors had been created in 1959 on the east coast of the USA and had, under their leader Charlie Spock, who had joined in

1966, aggressively looked for a way to have off-shore manufacturing. They had, in 1970-71, a base in Cumbernauld where they tested and shipped products made in the USA. They decided that they needed to increase their manufacturing base here and that their core technology of processing silicon wafers should be moved to Europe and to Greenock. The chips would be packaged in Singapore.

They were not the first to come here but it still was a leap of faith. What they hoped would happen is that they would be totally welcomed and in this they were proved right.



A Silicon Integrated Circuit connected to the world

Making a semiconductor chip is simple in concept. Silicon is the basic semiconductor and you have to change its electrical properties in different areas in order to create diodes, resistors and transistors. You do this by defining where you want it changed and then you change it only in this area. You then define another area you want to change and you change it and so on. This can go on for ten to twenty occasions. The defining process was called 'masking' and the silicon changing process was called 'diffusion'. All of this is done in a wafer Fab(rication) area where the wafer was a round, thin, three inch disc of silicon in 1971. Inside the Fab you wore special clothes to protect the wafer from you rather than you from the wafer. The contamination levels must be kept very low for the circuit to work.

In 1971 National set about hiring the team that would build this first Fab area. Bob Swanson, aged 33, came over as the plant manager and director of all operations for Europe. Bob was an ex-Fairchild man. He was Californian blond and always immaculately dressed. He lived in Kilmacolm while he was here and liked to drive a Porsche. With him came as the semiconductor process setup man, Richard Birk, who had been an engineering manager in Sunnyvale California. Dick, as he was known, was also about 33, over six feet, and built like an NFL quarterback. Dick lived in a large house in Kilmacolm too. Bob also brought with him the expertise of Ernie Friberg, another ex Fairchild man, to set up the Fab area building and its environment.



National Calculator 1

Bob Swanson, as plant director, was responsible for the administration staff for the company, such as Ron M'Clean as the accountant. Ron, I remember, wore gold rimmed glasses and a Gourock Royal Yacht Club tie. Working for him was Ann Greer, a young Port Glasgow woman. Also there was Colin Wemyss, the head of purchasing. Colin had a boat and had just bought a new house in 1971. Working for him were Doug Taylor and the red headed Margaret M'Guire who lived near Dunlop Street. All were new to this industry and relished the totally fresh work style and much higher wages.

Dick Birk searched for his first personnel to create a working wafer Fab. He needed a team of four key individuals with good semiconductor

experience. These were to be two engineers and two American style foremen, one each in Diffusion and one each in Masking. He hired Frank Hawe, engineer, and Jack Smith (myself), foreman in Diffusion and Russell Flack, engineer and Doug Stewart, foreman in Masking. All of us had technical degrees and semiconductor manufacturing experience in Britain.

All of us had to move into the area. Frank was English, educated in microelectronics in Southampton, and single. He was tall and frizzy haired with a really determined streak and an eye for detail (and a good squash player). You didn't want to cross him. He moved into a flat in Greenock at Broomhill. I myself, Jack Smith, was also single and living in Burnley. I had trained as an engineer at Mullard's Microelectronics at Southampton. I was single and was given an SSHA house in Port Glasgow. I just loved having a job in my home area. Russell Flack was married and also in England. He bought himself a house in Kilmacolm. It was on a new estate where there were fairly expensive private houses. The people of Kilmacolm however called it 'the Council Estate'. Doug Stewart was from Signetics on the East coast. He moved to Largs with his wife Pat and child Kirsty and drove a lovely twin carb MGB. All of us were wooed by the money. I had been earning £1800 per year and in a phone call interview with Dick was offered £2800. A lot of money for a 25 year old in those days (1971)!



National Watch 2

Engineers were responsible for all controls of the process and wrote all specifications. American-style foremen were responsible for all personnel, work flow, running of equipment and the meeting of specifications. There were squabbles and clashes between them but they had to weld into a team.

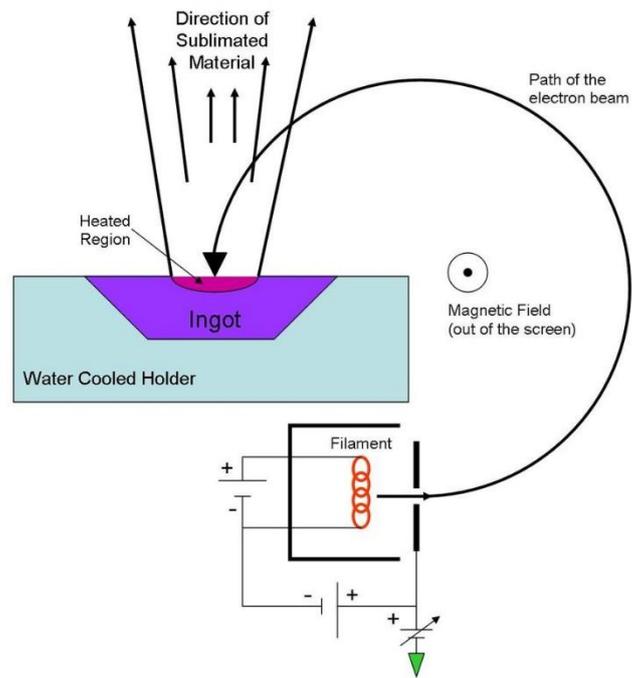
The first part of the start up was to set up the plant facilities and then to get all equipment shipped to Greenock. Ninety-nine percent came from California including the wet-processing benches, the air conditioning and the water purification equipment.



Wet Benches in Yellow room



The Kasper aligner in the Masking area



Electron Beam Evaporation



The furnaces in Diffusion



National Calculator 2

All Fab areas needed the highest quality air and the purest of water. These would become Ernie Friberg's major problems. Ernie was a five foot five inch American dynamo. He was stocky, stubbled haired and loved to wear, even in winter, loose, flapping Hawaiian shirts. He had worked in Germany, Sweden, France, and the Far East. He had, by this time of the start up, hired and trained local people such as Jack Wilkie and Ian Grant who did everything in the factory

Air was not a problem but the Scottish water was. The silicon wafer needs at all times to be absolutely clean to prevent defects. It is cleaned by very strong acids and these have to be rinsed off before the next operation. The water is so pure it is measured by resistance. Ernie could not get the water pure enough.



The water cleaning process

In fact he had to install on the Fab walls two lights, one red and one white and the wafers could only be rinsed when the light was white and above 5 mega-ohms which in the early days was not too often.

There are many processes for silicon wafers to turn them into integrated circuits. Each produces a different kind of electrical circuit although it may have the same logical functions. The process first installed at Greenock was low voltage PMOS (Positive-type Metal Oxide Semiconductor). Several trial batches of product were run twenty four hours a day through the whole process by the four key players personally. Frank Hawe had also to computer programme our testers in Stu Kuiper's device test area and slept several nights there to accomplish that. We all slept there at one time or another.

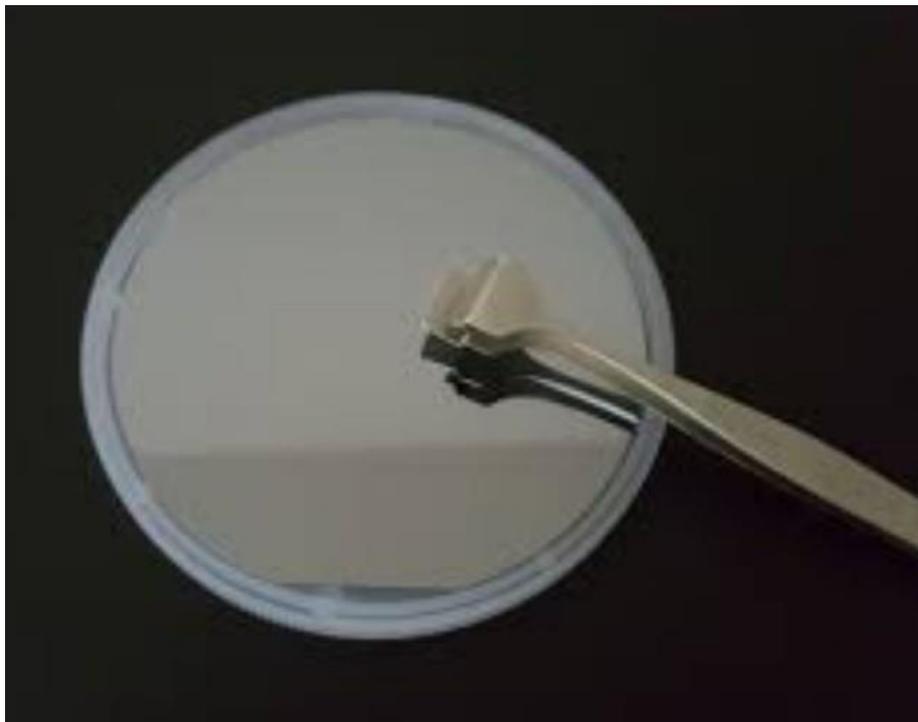
There were good device results in the end. We went jubilantly to the Melrose public house to celebrate and then to Dick Birk's house in Kilmacolm. I remember being driven there by Bob Swanson in his Porsche and him complaining as he drove past Scott's shipyard keeping our eyes open for police speed traps, "With your speed restrictions I can't get this car out of second gear!"



National Watches 2

It was decided we now had the process and it was time to hire our first operators. It was the two foremen who were given that task. Doug and I set up interviews in the old Labour Exchange above the main railway station where we chose from a fine group of candidates. We had hundreds applying and they were exclusively women of all ages. I can still recall some of the first few who stayed a long time with National. There was Betty Bunclark, Mary Hepburn, Jean Bogie, Margaret Cosgrove and Margaret Headley to name but a few. (I wonder where they all are now.). They took to this new strange way of working like ducks to water.

A major change they had to make in work attitudes was to take care in handling the brittle wafers and appreciate the value added to them as they processed through the Fab area. In those days damage could easily be done. Wafers were handled using tweezers for instance.



Tweezers and a silicon wafer

There were many different containers and each handling step was not good for yields.

Operators, all women, settled in and learned this new style of working but the early satisfactory electrical results could not be maintained and yields of good devices were low compared to Sunnyvale. PMOS technology is very sensitive to ionic contamination and the majority of the integrated circuits we were making did not pass our tests. It was found that the wafer cleans in Scotland had to be improved but I think the most

important company factor was that we were not meeting our expected quota. Dick Birk was recalled to California and replaced as engineering manager. Whatever happened in Scotland did not hold him back in the long run. He thrived. He went back to a very successful career becoming at one point a vice president at Supertex.



*Various containers.
including Teflon Carriers*

Changes were made in the Fab, yields met all expectations and National built a TTL (Transistor Transistor Logic) line and a Linear line based on that success. New people arrived such as Roy Ingles, Andy Dewar, Alan Botcheby, Russell Childs, William Pete and Alan M'Culloch as the company grew and each technology have their own stories of which there are many.



Owl Wizard

All four of the first PMOS Fab team did well in later life. Frank Hawe became chief technical officer in a Silicon Valley company and still lives there. Russell Flack became plant manager of a National Semiconductor plant in New Hampshire. Doug Stewart became a marketing director and lives well in Pitlochry, Scotland. And I enjoyed a twelve year “vacation” in USA, in California and Texas, finishing up working as a director of operations for AMD (Advanced Micro Devices).

I think a lot of the above success was due to National Semiconductors and its working ethos. Of all the companies I worked for National was the most go-getting type. I left to go to Motorola in East Kilbride in 1974. National tried their best to keep me with George Rutledge, the plant director, offering me a transfer to California if I wanted to. I didn't, but it showed how the company would try. Among the workers they used to say that you should come into work in the morning with all your guns blazing and in my days that was true. Bob Swanson left National Semiconductors in 1991 to form Linear technology and make his millions. He said, “For thirteen or fourteen years at National I was a gung-ho guy. Then the company started to get big. I kept looking at all the companies whose butts we had been kicking and then National started organising itself like them. It was frustrating.”

It is sad to see the end after so many years but it is important to remember that there are great memories to recall and hopefully record. Someone should start doing that now.

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