The Gove Project is one of the most ambitious enterprises in Australia's history, and is one of the largest projects ever undertaken in this country.

It is being carried out in partnership by Swiss and Australian interests.

The Gove Joint Venture was formed in 1968, between Swiss Aluminium Australia Limited (Austraswiss), and Gove Alumina Limited (Gove Alumina) to extract and develop the bauxite located in the deposits on the central plateau of the Gove Peninsula. The Joint Venture agreement was signed on January 22, 1969. Austraswiss is a wholly owned subsidiary of Swiss Aluminium Limited (Alusuisse), of Zurich. It has a 70% interest in the Gove Project. The balance of 30% is held by Gove Alumina.

Gove Alumina is a subsidiary of the Colonial Sugar Refining Company Ltd. (CSR). Its shareholders are:

- Colonial Sugar Refining Company Ltd. 51.01%
- Peko-Wallsend Ltd. 12.64%
- Australian Mutual Provident Society 12.10%
- The Mutual Life & Citizens Assurance Company Ltd. 9.10%
- Bank of New South Wales 8.08%
- Commercial Banking Company of Sydney Ltd. 5.05%
- Elder Smith Goldsborough Mort Ltd. 5.05%

100.00%

These companies are among the leaders of the financial, mining, manufacturing and rural industries in Australia.

NABALCO

The Manager of the Gove Project is Nabalco Pty. Limited, an Australian company owned equally by the Swiss and Australian participants. Nabalco is the first letters of North Australian Bauxite and Alumina Company. It was formed in 1964 to investigate and develop the bauxite deposits at Gove, which have proved to be among the largest in the world.

Bauxite is a major source of aluminium — the most plentiful metal in the earth's crust — and there is more bauxite in Australia than in any other country of the world.

There are more than 250 million tons of high grade bauxite at Gove, and the Gove Joint Venturers are spending $A310 million to develop these deposits.

Nabalco holds no equity in the project. Its functions are to design, plan, build and operate the mine, materials handling system, alumina plant, port, town and utility services, and to manage the Project.

In April, 1966, the first Nabalco staff moved to Gove; the test drilling and sampling programme was commenced in June; in July, the first shipment of bauxite was despatched to Venice for test processing; and in the same month, Nabalco moved into its new camp beside the airstrip. This area is now called Prospect.

Most of the construction work at Gove is now complete:

- in July, 1971, export shipments of bauxite commenced at a potential rate of two million tons a year.
- construction of the town of Nhulunbuy was completed in June, 1972.
- the first stage of the alumina plant was basically completed in June, 1972, and, after commissioning, alumina production commenced at the rate of half a million tons a year in July, 1972 — ahead of schedule.
- the second stage of the treatment plant is planned for completion by the middle of 1973, when production will be increased to one million tons a year.

After having carried out the feasibility study, Nabalco planned and designed the entire Gove Project. It has drawn up, negotiated and administered a great number of contracts, of which more than 40 were worth $1 million or more, including the contract of $35.4 million for the air conditioned town.

Nabalco has also planned and managed all the complex logistics, such as transporting more than 400,000 tons of plant, equipment, and materials; accommodation and catering for 3600 construction workers; power, water, site transport, and so on. All these logistic construction services were carried out on the edge of the continent — more than 3000 km away from the major Australian concentrations of population and industry.

Power for the Gove Project
HOW THE PROJECT BEGAN

In 1963, the Australian Government called for applicants to develop the bauxite deposits at Gove, after the lessee had indicated its inability to develop the deposits. In 1964 CSR joined Alusuisse in its application for the lease.

The Government granted the lease in September, 1965, to Nabalco, which had been formed in 1964 to develop the lease.

It was a condition of the lease that Nabalco would construct in the Northern Territory an alumina plant with a capacity of at least half a million tons of alumina a year, based on Gove bauxite.

Nabalco would be released from its commitments if it were found that the deposits contained less than 100 million tons of bauxite of a specified minimum quality.

At that stage the estimated quantity of bauxite was about 100 million tons and the estimated investment was approximately $100 million.

The first known geological reconnaissance at Gove had been made in 1952, but no mining rights had been taken out until 1958.

Alusuisse had first become interested in Australia through being called in by the Australian Government in 1960 to advise on technical improvements to the Government's aluminium smelter at Bell Bay, in Tasmania.

At about the same time, an urgent need had arisen for a new and reliable supply of bauxite to provide a source of alumina for Alusuisse's plants in Europe and North America.

Alusuisse began as the Swiss Metallurgical Company in 1888 to produce pure aluminium by the electrolysis of alumina, using a process developed two years earlier by a Frenchman, Heroult, and shares with Alcoa the distinction of being the world's oldest aluminium producers.

Today Alusuisse is involved in every stage of the aluminium industry, from the mining of bauxite to the fabrication of finished products. In recent years it has been active in the chemical and plastics industries. It now operates in 17 countries as widely separated as Iceland and Australia.

When Alusuisse management learnt of the availability of the bauxite deposits at Gove, it invited CSR to join it in applying for the lease and investigating the possibilities of developing the reserves commercially. CSR agreed to join Alusuisse. CSR is one of the largest commercial and industrial organisations in Australia. It had adopted a policy of diversification from sugar milling and refining, and distilling, into chemical processing, manufacturing, fabrication, concrete, building materials, and mining and quarrying.

CSR played the leading part in the setting up of the Mount Newman Iron Ore project in Western Australia, and its response to Alusuisse was a logical extension of its widening activities, particularly in the building materials industry.

Alusuisse and CSR were joined subsequently by the AMP Society, Australia's largest life assurance society, and the MLC, another leading Australian life office; Peko-Wallsend, one of Australia's largest mining companies — producing copper and rutile, zircon, silver, bismuth, coal and iron ore — and the nation's largest gold and scheelite producer; Bank of NSW, Australia's oldest bank; the Commercial Banking Company of Sydney; and Elder Smith Goldsborough Mort, a leading rural industries company which, like CSR, had diversified into investment, manufacturing and mining.

These partners — Swiss and Australian — all became shareholders in Nabalco.

Immediately after being granted the Gove lease, Nabalco commenced a comprehensive study of the Gove bauxite deposits and their commercial potential. After two years of investigation, when the report had established that development was feasible, the Swiss and Australian partners decided to reorganise their association into a Joint Venture, in place of the existing company structure.
The feasibility report which summarised two years' work and $2 million investment.

Nabalco Project Division drawing office in Sydney.
THE FEASIBILITY STUDY

Following a photogrammetric aerial survey of the Gove Peninsula in 1965, various possible schemes for the location of harbour and production facilities, town, and transport system were examined and compared during the feasibility study carried out during 1966 and 1967.

At the same time, a pilot alumina plant was built and operated in Venice to ascertain the behaviour of Gove bauxite and determine the process conditions for the full scale plant at Gove.

The feasibility study included:
- complete investigation of the site to determine the quantity and quality of the bauxite and to study topography, geology, meteorology, hydrography, sea conditions and structure of the soil
- drilling the whole lease area on at least a 200m grid, much of it on a 100m grid, with about 30km of samples drilled, totalling 5,500 holes, and with 30,000 core samples sent for analysis to the Alusuisse research institute in Switzerland
- design of the alumina process by means of laboratory tests, pilot plant tests with Gove bauxite, and a computer programme to evaluate process variations
- conceptual design of all facilities, including study of various locations for the alumina plant, the harbour, transport systems and the town
- study of future organisation, a time schedule and available resources
- estimate of investment cost and operating cost, including a complete economic evaluation of the project.

The first objective was to determine the sites for the three principal elements of the project — plant, harbour and town — and to decide the manner in which the bauxite would be transported to the plant.

One of the most important requirements was harbour facilities for berthing ships of up to at least 60,000 tons in all tidal conditions, and up to 100,000 tons on favourable tides. There was a limited number of choices — ranging from an area with deep water close to the eastern edge of the reserves, but strongly affected by wind and wave action, to an area about 20 km west of the reserves in a more sheltered location.

The alumina plant needed to be located close to the reserves or to the harbour.

Alumina plants, which convert bauxite into alumina, have a relatively low electric power requirement, and need large quantities of fresh water. It is also necessary to have substantial storage for alumina in silos before shipments are made.

As a result of technical and economic evaluation, the selected scheme was:
- mining operation, with crushing station located in the area north of the airstrip, and transport of the bauxite by an overland belt conveyor system to the stockpile, alumina plant and marine terminal at Dundas Point
- the alumina plant with an output of one million tons a year built in two stages of 500,000 tons, located on the Dundas Point peninsula close to Gove Harbour
- a marine terminal on the spit of Dundas Point, with a general cargo terminal east of the spit and a bulk terminal west of the spit
- a complete town named Nhulunbuy, located between Mt. Saunders and the beach south of Cape Wirawawoi, about 10km east of the plant site
- wells and treatment plant for fresh water near the Gove airstrip, with pipelines to the town and the plant.

The report on the feasibility study was presented to the Australian Government in March 1966. It was described by the Minister for the Interior, the Hon. Peter Nixon, as "... a remarkable document. I feel sure that never before has so comprehensive and so fully documented a report on a prospective mining venture been presented to an Australian Parliament. It represents the result of two years of continuous study and its presentation is a credit to all concerned with it."

The report showed that:
- investment would be higher than originally estimated mainly due to the remoteness of the area
- proven bauxite reserves were at least 250 million tons
- for the project to be viable it would be necessary to increase its capacity to one million tons of alumina a year and to export 40 million tons of unprocessed bauxite over the first 20 years.

In June 1968, Alusuisse and CSR agreed that the Gove Project should include the expanded alumina plant and that the investment sharing would be changed to its present ratio — 70% Austraswiss and 30% Gove Alumina.

Geological Survey
Mining and materials handling (from bottom left): Sample drilling; front end loader tipping bauxite into 50-ton dump trucks; the crushing station; the stacker; the stockpile.
The average thickness of the orebody at Gove is three to four metres. Bauxite occurs in three main forms:

- loose pisolith — round pea-sized grains loosely cemented into a fine grained matrix, constituting about 30% of the orebody
- cemented pisolith — pea-sized grains firmly cemented with fine grained bauxite material (about 35%)
- tubular — a continuous massive structure full of irregular tubular cavities of vesicular form (vesicular latere — about 35%)

Mine production is planned on field assay drilling carried out on a 25 m grid base and laboratory analyses of drilling samples. Consistency of quality is achieved by selective mining from vertical faces after analysis of the samples has determined the sequence in which areas to be mined to ensure required blending of the ore. At later stages, blending is further achieved by the ore stacker which moves along the stockpile depositing layers of ore as it goes, and the reclaimers recovering ore from the whole face of the stockpile.

Front-end-loaders excavate the ore after blasting or ripping as necessary. 50 ton capacity trucks take the bauxite to the crushing station where the ore is crushed to less than 25 mm diameter.

CRUSHING STATION
The 50 ton dump trucks tip the ore into the twin 200 ton hoppers at the primary crusher.

Variable speed hydraulic-powered apron feeders empty the dumphoppers onto vibrating grizzly screens, where the minus 150 mm material is separated and bypassed to the screen house. The plus 150 mm material moves into the primary crushe.

The crusher, with a rotor weighing 27 tons, has a total weight of 84 tons. It is powered by two 650 hp 6.6 kV motors and has a capacity of 1470 tons an hour, handling up to 1.5 m edge length lumps of bauxite.

The material then moves into the screen house, where twin vibrating screens separate the minus 25 mm ore which passes into the surge bin.

The plus 25 mm ore is fed into the secondary crusher, a Hazemag AP6 weighing 22 tons and powered by one 650 hp 6.6 kV motor, which crushes at the rate of 600 tons an hour.

Having been transported via conveyors up into the 1700 ton surge bin the material is fed by means of two 1.8 m belt feeders, with D.C. variable speed drives, onto an accelerating belt 1.2 m wide from which it is transferred to the overland conveyor.

MATERIALS HANDLING
The overland belt conveyor is 18.7 km long from crushing station to stockpile at the plant site. Other conveyors bring the total length of the system to 27.4 km.

The overland conveyor consists of three sections — 57.5 m, 53.15 m and 6401 m long. The belts are 0.9 m wide. Other belts in the system are 1.2 m and 1.8 m wide. All are of steel cord and 17 mm thick.

The belt on the overland conveyor has a speed of 3.5 m a second. Bauxite travels the 18.7 km from crushing station to stockpile in about 1.5 hours.

The system is fully automatic from mine to plant or to wharf and is operated by one man from the main control centre at the head of the stockpile. Other control stations monitor various conditions.

Once the start button is pressed, the start for each belt is monitored in the main control centre and with all systems in order, the No. 1 belt 18.5 km away starts last, eight minutes later. This allows for the start of a fully loaded belt. The operator can vary the speed of the belts.

At the end of the conveyor the bauxite is stockpiled by a stacker which operates automatically. The stacker travels the full length of one stockpile and returns for a preset number of runs. Then the boom lifts into the next highest position and the stacker travels the preset number of runs again. This cycle goes on until the stockpile is completed. The boom then turns to build up another stockpile parallel with the first.

The stacker is repositioned from one area to another through manual control from the stockpile control cabin.
The recovery of alumina from bauxite by the Bayer process is basically simple but technologically complex. The process for the treatment of Gove bauxite was worked out after a careful study of the composition of the material, and trials in the pilot plant in Venice.

Bauxite from the stockpile is fed into large grinding mills where it is reduced to very fine particles, and mixed with hot caustic soda. The mixture is then passed through a series of steam-heated digestors where the temperature is raised. The alumina is dissolved out of the suspended bauxite, and the resulting hot slurry is diluted to help remove insoluble impurities such as sand and iron oxide, and passes through a series of vessels to remove the silica.

The ferrosilt, which contains the impurities, is separated from the aluminate liquor in large thickening tanks. It is then washed free of liquor in a series of wash thickeners before being pumped to disposal areas. The liquor is passed through pressure filters to remove residual impurities, cooled by heat exchangers to 50°C, and pumped into a series of vessels of 3000 m³ capacity and mixed with large amounts of seed hydrate to precipitate the alumina hydrate.

The alumina hydrate slurry is filtered and the liquor returns to the process. A large proportion of the alumina hydrate is returned to the precipitators as seed hydrate. The remainder, production hydrate, is washed and dried carefully on drum filters. Then it is fed into calcining kilns operating at very high temperatures to produce alumina (aluminium oxide). Throughout the cycle, wherever appropriate, heat energy is conserved by heat exchange between liquor streams. Alumina is a fine white powder and is stored in two 50,000 ton concrete silos to await export.

By mid-1973, the storage capacity will be doubled by the addition of a 100,000 ton silo now under construction. When completed, it will be the largest alumina silo in the world.

A steam power station supplies process steam to the plant, and 112.5 MW electric power, generated by three 35 MW back pressure turbines and one 7.5 MW condensing turbine. A stand-by diesel power station of 14 MW capacity provided power during early construction stages.

Power is distributed through 72.5 km of 22 kV overhead high tension cables to plant, port, materials handling system, mine, town and ancillary works.

A complex instrumentation system controls the process and logs data from the systems.

The two existing 50,000 ton silos were built by the slip form construction method, the first in 10 days and the second in seven days, to the top of the 38 m high walls. The 100,000 ton silo will be of an entirely different shape and design from the existing structures, with low walls and large conical roof. A model has undergone an exhaustive wind-tunnel testing programme at Sydney University.

THE BULK EXPORT SYSTEM

There are two drum-type reclaimers, one to feed the export conveyor system and the other to feed the alumina plant. They work from separate stockpiles. The drum on the export reclaimer is 33.5 m long and 5.5 m in diameter. The reversible rotating drum has 64 buckets attached to the outer surface. The buckets scoop from the base of the stockpile and deliver to a belt. The face of the stockpile is agitated by an oscillating rake, causing the material to flow down into the path of the buckets. Material can be reclaimed at about 2200 t/h.

The shiploader traverses the 165 m bulk terminal which is 1006 m from shore. It has a telescopic boom with a maximum reach of 36 m and can load carriers up to 100,000 tons. Height is 50 m above water level. Minimum depth of water at low tide is 14 m.

The alumina plant reclaimer feeds bauxite at 400 t/h into the grinding mill at the start of the treatment process.

From the silos the alumina is fed by air slides onto a 1.8 m wide export conveyor belt and moved 1850 m to the export loader on the bulk cargo wharf. The export conveyor is wider from this point to cope with lower density alumina, and it incorporates a washing system that cleans the belt after each shipment of bauxite. The bulk cargo terminal incorporates a 156 m bridge to the tanker pier. The entire terminal is constructed of tubular steel piles with steel superstructure. The tanker unloading and shipping platforms are of reinforced concrete.

The bulk cargo wharf berthing facilities consist of six breasting dolphins and two mooring dolphins; the tanker pier has four breasting dolphins and one mooring dolphin. Tankers may also use one of the bulk cargo mooring dolphins.

Four pipes run from the tanker pier to the shore and are used for transporting Bunker C fuel oil, diesel oil, petrol, caustic soda and fresh water. Water runs in the reverse direction as it is used to supply ships.

The shiploader weighs 400 tons and is 36 m above the wharf. It travels back and forth alongside a conveyor belt which runs the length of the bulk cargo gallery. The bauxite is fed through the shiploader and loaded into the ships at a rate of 2200
Flow chart of alumina process.

Aerial view of Dundas Point, showing marine terminal, alumina plant and stockpile.
The various sections of the alumina plant are almost factories in themselves—grinding mills, evaporation, precipitation, thickening and
settling tanks, filtration, steam power station, calcination, storage. The entire plant is massive, covering more than 20 hectares of Dundas Point.
Loading bauxite into m.v. "Shozen Maru".

M.v. "Shozen Maru" alongside bulk terminal.
tons an hour, and alumina at 2000 tons an hour.
The shiploader is under the control of an operator in a cabin above the loading boom.
The bauxite which passes through the shiploader is exported to Japan and Europe. Alumina is being exported initially to smelters in Europe, the United States and Asia. There it will be smelted by electrolysis into aluminium, which is being put to more uses every year, because of its particular qualities.

Aluminium — the versatile metal
Aluminium is:
light
with a specific gravity of 2.7, aluminium is about 1/3 as heavy as iron
strong
high-strength aluminium alloys reach the strength of ordinary structural steel
resistant
its compact, natural oxide skin protects aluminium against weathering and chemical action
a good electrical conductor
an equivalent conducting aluminium cross section is 1.6 times the corresponding copper cross section, but leads to a weight saving of about 50%
a good thermal conductor
although the melting point of aluminium is considerably lower than that of steel, because of its greater thermal conductivity, the heat required for welding aluminium, for example, is about the same as that required for steel
a good reflector
aluminium is a good reflector of heat, light and electro-magnetic waves
non-magnetic
even iron additions have little effect on the non-magnetic properties of aluminium since iron is present in aluminium in a paramagnetic phase
non-toxic
both the metal and its salts are non-toxic. Man takes about 12 mg of aluminium daily in his food without any harmful effect
ductile
aluminium can be shaped by all the common forming and cutting processes
decorative
through surface treatment processes of various kinds aluminium can be used to give the widest possible variety of decorative effects

Alloying
Superpurity aluminium (Al 99.98% and over), high purity aluminium (above 99.8% Al) and pure aluminium (Al 99.0%-99.8%) possess certain properties which, for special purposes, can be improved or modified by addition of one or several other elements, i.e. by alloying. In this way, among others, high strength alloys with strengths corresponding to those of ordinary structural steel are obtained.

Basically aluminium alloys fall into two groups:
- alloys which are not treated with heat
- heat treatable alloys

Aluminium alloys are further divided into casting alloys and wrought alloys according to subsequent treatment.

Wrought alloys
The highest purity aluminium: for applications in the chemical industry, foils for electrolytic capacitors.

Material which can be brightened; for reflectors, decorative uses and strip for vehicles, furniture, watch cases, jewellery, instrument panels, optical equipment.

Casting alloys
Medium strength heat treatable structural material. Heat treatable alloys for general use suitable for decorative anodising: ship building, rolling stock, road transport vehicles, architecture, materials handling equipment.

Heat treatable alloys for general use suitable for decorative anodising: ship building, rolling stock, road transport vehicles, structural engineering, building, electrical applications and apparatus.

Grey coloured alloy for interior and exterior architectural applications.

Medium strength heat treatable structural material.

High strength heat treatable structural material.

Very high strength heat treatable structural material.

Free machining alloy.

Conductor material.

Casting alloys
Medium strength material with good casting properties.

Heat treatable alloy for components that are difficult to produce and requiring high strength.

Moderately good castability, suitable for decorative anodising, easily worked, excellent resistance against seawater.

Heat treatable alloys of the highest strength suitable for parts subjected to impact or repeated stress; reduced chemical resistance.

Naturally ageing alloy of medium strength, specially suitable for sand casting and decorative anodising.
NHULUNBUY

Few towns or cities are planned and then built. Most are built and then planned, if they are planned at all. Canberra, the Australian capital, is one of the exceptions.

Nhulunbuy is another.

Both Canberra and Nhulunbuy are fine examples of town planning, and population centres of great, if varying, beauty.

An “instant town”, Nhulunbuy has been designed, planned and built to create a feeling of permanence and solidarity. Construction is mainly of pre-cast concrete, and all buildings, including most dwellings, are air conditioned.

Various types of family accommodation are available — 156 two-bedroom flats in 13 blocks of 12 flats, 402 three-bedroom houses and 57 four-bedroom houses. Of these, 60 houses were built by Nabalco on behalf of the Commonwealth Government to provide homes for its officers at Gove, but these are not air conditioned. There are also six blocks of single staff quarters providing single accommodation for 460 men and 48 women.

William Gove House, named after the airman who died in World War II and gave his name to the peninsula, is the amenities centre for single staff. It contains a dining room to seat 500 people, a large sitting room, records and games rooms, meeting rooms and two outside courtyards.

The new town is fully served with drainage, sewerage, power, water supply and sealed roads, fully kerbed and guttered.

Education needs are well served with a pre-school centre and higher primary school, both of which are equipped with the most modern teaching aids and facilities. A separate primary school is planned for 1974/75 and the higher primary school eventually will be upgraded to a full high school.

All basic subjects are provided at secondary level and the curriculum follows the South Australian system.

Adult education classes are available, and sessions are held for pottery, painting, woodwork/metalwork, drama, handicrafts and music.

A hospital complex with a 64-bed nursing block, administration block, services block, fully equipped operating theatre and nurses quarters, is sited on the south-east slope of Mt. Saunders.

An ambulance service is operated in conjunction with the hospital and the Northern Territory Aerial Medical Service has an aerial ambulance stationed permanently at Gove Airport. A 24-hour emergency medical service is available. Nominal charges only are made for all services, and drugs dispensed are provided free of charge.

A dental clinic and infant health centre share a building in the town centre. All charges are minimal and emergency dental treatment is available.

The shopping mall in the town centre incorporates a supermarket, pharmacy, butcher, newsagency and stores selling fashion goods, dress materials, haberdashery, electrical appliances, gifts, menswear and sporting goods, men's and ladies' hairdressers and a milk bar including take-away food also operate.

The town centre complex includes bank premises, town administration offices, library, community hall, post office, police and fire stations, court house, airline agencies and Commonwealth Administration offices.

Near the town centre is a community club with a recreation centre including tennis courts, bowling green, covered all-purpose court and change rooms. An Olympic size swimming pool is located nearby.

The Walkabout Hotel with several bars, restaurant facilities, 42 guest rooms and a hire-car service, overlooks a freshwater lagoon and the Arafura Sea.

In addition to the services and facilities directly within the town centre, a retail store, agency bank facilities, non-official post office, and airline passenger and freight offices are located at Wallaby Beach.

The post office at Nhulunbuy has full telephone, telegraph, and postal facilities, and provides Commonwealth Savings Bank services.

An automatic telephone system is installed throughout the area and trunk line services are connected to Darwin through an effective troposcatter system.

A guest house with restaurant facilities is established at Prospect, not far from Gove Airport.
Garden and swimming pool of Walkabout Hotel at Nhulunbuy.

Aerial view of Nhulunbuy showing: (foreground) two-bedroom flats; (middle distance) staff single quarters, Walkabout Hotel, town centre, and higher primary school; (background) housing neighbourhoods.
Mrs. Romain Zufferey, of Valais, Switzerland, was the first woman on site, and is the only woman remaining from the early Nabalco pioneers. Mrs. Zufferey is a keen gardener. Her husband is Nabalco’s chief mine mechanic, and they have three children.

Relaxation on the one day off a week takes many forms—including parties.
The Gove Peninsula is undulating, but relatively flat, with a central plateau rising to about 55 m above sea level. The soil is mostly a loose to rocky laterite, with occasional granite outcrops.

The vegetation varies. Inland, especially on the higher ground, it is open parkland, with many eucalypts, including Darwin stringybarks, and other tropical hardwoods, and with low undergrowth. Coastal vegetation is more luxuriant, with heavy undergrowth, and there are some mangrove swamps.

Gove is well within the tropics, only 12° south of the Equator, and is subject to wet and dry seasons.

The climate, however, is never severe.

Average rainfall is 1.36 m, with a relatively high humidity at the onset of the wet season, which lasts from November to May.

The temperature fluctuations are much less extreme than those experienced in Sydney or Melbourne, but the temperatures are consistently high.

The average maximum temperature during June and July is about 27°C. This rises to 34°C in November and December. From January to March, the average minimum temperature drops to about 26°C. Average night temperatures remain at about 15°C, even in the coolest months.

Strong winds of up to 50 km.p.h. occur sometimes from April to October and during the wet season there are occasional gale force winds.

There is ample fresh water in the Gove Peninsula. It comes from a ground aquifer about 15 m above sea level, under the bauxite deposits in the central plateau. The safe yield is between six and eight million gallons a day. This is sufficient for the development of the Project.

There are no roads into Gove, and no railway. The most likely overland route to Darwin is about 750 km long, and involves many river crossings; another likely route, avoiding the crossings, is over 1000 km long.

Access is by air and sea for people, plant, equipment, supplies and provisions.

By air, the Gove Peninsula is about 650 km east of Darwin, 965 km west of Cairns and 1290 km north-west of Mt. Isa. It is closer to Singapore than to Sydney.

There are 15 commercial airline flights a week into Gove plus some freight flights.

MacRobertson-Miller Airlines (MMA) operates seven flights a week by F28 Fellowship jet aircraft from Darwin. Ansett and TAA each operate two flights a week from Cairns and two from Mt. Isa, using F27 Friendship turbo-prop aircraft. Most of these flights have direct connections with jet flights to and from the large cities in the southern and eastern States. Small charter planes are readily available from Darwin.

The landscape is an attractive combination of white beaches, red cliffs and timbered slopes. Cool sea breezes blow along the coast and across the site of Nhulunbuy, on the slopes of Mt. Saunders.

Nhulunbuy is the Aboriginal word for the hill named Mt. Saunders by Captain Matthew Flinders when he anchored in Melville Bay in 1802.

Swimming is safe from most beaches except during the wet season from November to May, when venomous sea wasps make swimming extremely dangerous.

Many families have portable swimming pools and public pools are provided at Wallaby Beach and Nhulunbuy South as well as the Olympic sized pool in the town centre.

Sailing is popular within the shelter of Melville Bay and water skiing from sheltered coves in Melville Bay is practicable, except on days with high winds and in the wet season.

Reef fishing is popular with coral trout, cod, red emperor, sweet lip and snapper being readily caught in good numbers.

More sporting fish are tuna, stratum, barracuda, mackerel, queen fish, trevally and shark taken in the open sea, and from the rivers, bream, mangrove jack and barramundi.

Regular tennis, cricket, soccer and rugby matches are organised.

The Gove Country Golf Club has laid out a nine hole course with watered fairways and sand greens. Regular competitions are held and there are plans to extend the course to 18 holes.

A wide range of social, recreational and community facilities are catered for and include school committees, a technical society, conservation group, Lions Club and Ladies' Auxiliary, youth club, rescue and safety committees including cyclone safety, skin diving club, basketball club, boating club, gymnastics and yoga, children's ballet, gun club, Boy Scouts, Girl Guides, Cubs and Brownies, surf life saving club.

A three-bedroomed house at Nhulunbuy
For the people of Nabalco, the feasibility study and then the planning, designing and supervising construction of the Gove Project has been an eight-year task. Bringing the complex project into operation on time and within budgeted cost has been an engineering and administrative feat of considerable magnitude, not only by Nabalco, but also by the many contractors to whom Nabalco entrusted various phases of the work.

Contractors and the men who work for them have shared with Nabalco the achievement of bringing into being one of the world's great industrial achievements.

There have been more than 100 contractors, numerous sub-contractors and hundreds of suppliers. A few of the major contractors are overseas companies, who operate from Australian bases, and the benefit to Australian manufacturers and suppliers has been substantial. More than 90% of the total construction cost has been or will be spent within Australia.

The organisations which have helped to supply and build the Gove Project range from huge multi-national companies providing a range of services and products in many countries to one or two man operators who move from contract to contract, living as they go.

Contractors responsible for the major works were:

- Bernard-Smith P.D.M. of Australia, tanks and vessels \$A million 18
- Ralph M. Parsons of U.S.A., steam-power station 18
- Dillingham-Jennings-Mainline (A. V. Jennings of Australia, the Dillingham Corporation of Hawaii, Mainline Corporation of Australia) — construction of the town and ancillary works 40
- Transfield Pty. Ltd. of Australia, including Transbridge and Zincline — general civil engineering and surface protection 24
- Weserhuette Otto Wolff of Germany — materials handling 12.9
- Poon Bros. of Australia, catering 11.3
- P.D.C. Constructions Pty. Ltd. — various construction contracts 13
- Clyde Carruthers Pty. Ltd. 10.5
- Fischer and Porter Pty. Ltd. 7

The Aggregate Quarry

John Holland (Constructions) Pty. Ltd. 8
Leighton-Atkinson Joint Venture 8.5
Dorr Oliver Pty. Ltd. 1
Simon Carves (Australia) Pty. Ltd. 2.5
Tubemakers of Australia Ltd. 4.8
T. A. Mellen Pty. Ltd. 3
Sumitomo Shoji (Aust.) Pty. Ltd. 1.9
Noyes Bros. Pty. Ltd. 5.1
Hastings-Deering (N.T.) Pty. Ltd. 1.6
South Pacific Insulation Pty. Ltd. 3.3
Chicago Bridge Australia Pty. Ltd. 3.4
Davis Contractors 6.1
Pioneer Concrete (Qld.) Pty. Ltd. 6.8
Eglo Engineering Pty. Ltd. 2.2

Many of the contracts involved unusual features — such as the slip-form construction used in the building of the two 50,000 ton alumina silos, and the Hochstrasser-Weiss system to drive 0.6 m diameter bored piers to bedrock, 12 m below ground level in the foundations of the precipitation area.

THE COMMONWEALTH

The Australian Government has played a vital part in the Gove Project.

It has contributed nearly $18 million towards the construction of Nhulunbuy, including provision of the hospital and medical services, school, post office, police station, court house, fire station and administrative offices.

The Department of Civil Aviation has co-operated in the establishment by Nabalco of the airport, and the Department of Shipping and Transport in the creation by Nabalco of the Port of Gove (Melville Bay).

The Postmaster-General's Department has established a tropospheric scatter telecommunications chain from Darwin through Arnhem Land to provide Gove with adequate links with the world outside.

Customs and Excise has been closely identified with several aspects of the Project and a full time Customs Officer is stationed at Nhulunbuy.

The Departments of the Treasury, Trade and Industry, National Development, Labour and National Service, External Territories, Health, Education and Science, and Works have all played some part in the development of Gove.

Overall, the Minister for the Interior, as the minister responsible for the Northern Territory, and his departmental officers in both Canberra and Darwin, have played a leading role in a great partnership between Government and private enterprise.

The day-to-day dealings of the Commonwealth with the Project are handled largely by the Northern Territory Administration, whose headquarters staff at Darwin are relatively near neighbours of Nabalco's management at Gove—the 650 km air distance being little more than an hour's journey by jet aircraft.
Steam power station, Marine terminal, alumina silos and surface protection, Central control room, Inside the steam power station, Ferrosil disposal system, Alumina plant laboratory.
One of the highlights of the past two years was the visit of H.E. The Governor-General, The Rt. Hon. Sir Paul Hasluck, G.C.M.G., G.C.V.O., K.St.J., who was visiting old friends and took the opportunity to renew acquaintances. Although new ways are slowly taking hold in the Yirrkala community, the children mixing freely with white Australians, many of the traditional activities continue as they have gone on for centuries—including handicrafts and corroborees.
The Gove Project is built within the Arnhem Land Aboriginal Reserve. As a consequence, mining royalties are paid at double the rate which would otherwise apply.

Gove Alumina pays 30 cents a ton on bauxite exported and Gove Alumina and Austraswiss pay between 10 cents and 20 cents a ton (according to a formula) on bauxite converted to alumina.

The royalties are paid into the Aborigines Benefits Trust Fund which is administered by the Australian Government for the benefit of all Aborigines in the Northern Territory. These royalties are estimated to amount to about $850,000 a year by 1974, when the project will be producing one million tons of alumina a year and exporting two million tons of bauxite a year. The Aborigines in the community at Yirrkala and elsewhere in the Gove Peninsula will receive 10% of the royalties payable by the Commonwealth Government into the trust fund from the Gove Project. They are also entitled to participate in benefits from the fund. The Yirrkala Mission is 37 km from the plant and 13 km from the mining operation. About 700 Aborigines live at Yirrkala of whom more than half are under the age of 16.

In preparing the sites of the marine terminal, alumina plant, town, and crushing station, and during mining, trees and undergrowth were removed to make construction possible, and for fire protection.

Care was taken, however, to retain as many trees as possible, particularly in the town area, and a reafforestation programme has been adopted to beautify residential and industrial locations. Trees and overburden removed during the mining operations will be progressively replaced in a carefully controlled rehabilitation programme.

Large areas of the natural environment are being retained and emphasis is placed on attractive landscape gardening.

A tree and plant nursery has been established near the hospital and another is in operation at Yirrkala. The Aboriginal community also operates a market garden, brickworks, laundry and several Nhulunbuy town services.

The Aboriginal legend, culture, history and sacred sites in the Gove Peninsula are all respected by Nabalco.

Aborigines of the area are noted for their bark paintings and other artifacts.

Before the Mission was established in 1935, by the Rev. Wilbur Chaseling, the Aborigines now in the Yirrkala community existed in small groups and moieties, hunting and roaming across north-eastern Arnhem Land.

They hunted kangaroos, wallabies, crocodiles, and buffalo introduced into Northern Australia by early Malay traders.

There are also considerable numbers and varieties of colourful birds.

Over the centuries, the way of life of the Aborigines had evolved slowly. The establishment of a settled community, with permanent houses, a Christian Church and a Government school reshaped their lives.

The Gove Project has accelerated a process that was already in motion. It has speeded the emergence of men who are assuming the responsibilities of leadership through the Yirrkala Council, which confers regularly with Nabalco on matters of common interest. In this way, as in many others, the Gove Project is helping in the development of Australia.
In early 1967, Nabalco had a total workforce of 64 people, 31 of them at Gove, living in rough conditions, carrying out field surveys and tests both for the feasibility study and for advance planning of the project. The size of the workforce at Gove remained relatively stable for a while but in Sydney there was a build-up of technical and administrative people involved in the detailed planning of the venture and preparing for the start-up of construction. By January, 1969, more than 300 people in Sydney were involved in the preparation of detailed technical information and in administrative planning for the support and maintenance of the large construction workforce that would be required.

When the "green light" was received in January, 1969, recruitment began in earnest. The workforce at Gove grew steadily until September, 1971, when a peak of 3663 people was reached, and remained at a high level right through to the completion of the first stage of construction.

By this time Gove was starting to take on the character of a town rather than a construction camp. The total population had grown to 4420 including 324 families, with a total of 757 women and children.

Most of the construction workforce was employed by the many contractors involved in the project. These people, from a variety of countries brought with them the many skills necessary for a project of this kind, and performed their tasks at a high level of efficiency. They worked 10 hours a day, six days a week, in a hot tropical climate in one of the remotest areas of Australia — and they did it for months on end.

They created a community spirit and camaraderie which assisted them to overcome their problems. These things — and a sensible industrial relations policy which enabled grievances to be settled quickly — were the main reasons why construction has continued almost entirely uninterrupted by industrial strife. Gove has lost only 1.51% of the total available working time during the entire course of construction.

Not all the human effort on the project took place at Gove. From January, 1969, onwards, substantial administrative, logistic, and technical planning functions were performed in Sydney to co-ordinate and support the construction work at Gove. The people in Sydney provided an efficient back-up force for the construction project and formulated the policies and procedures necessary for the smooth operation of community and industrial enterprise. Nabalco is a very young company with no history or background of its own in policies, systems, functions — so all these had to be developed from scratch.

This was one area where the contribution of skills and experience of the Swiss and Australian partners proved to be invaluable.

To ensure continuity of construction, it was necessary to co-ordinate the supply of materials and their arrival at Gove at the right time, to work out construction timetables, and to prepare plans and specifications, to recruit, maintain and support a workforce of over 3000 people, to institute financial controls to keep the construction work within the required economic limits.

Unlike most similar enterprises who contract out the construction planning and management of their projects, Nabalco has carried out this job itself together with all the forward planning needed for the operation of the enterprise when construction has finished.

In the past three years, more than 25 million man hours have been worked at Gove by thousands of people, and a further five million man hours in Sydney.

These hours have been worked by people. People in dark suits and people in tattered shorts. People in hard hats and people in head bands. People working at desks and people working with drills. Directors, managers, supervisors, labourers, engineers, fitters, boilermakers, welders, draughtsmen, clerks, typists, miners, cooks, drivers, lawyers, accountants, economists, buyers, mechanics, bricklayers, carpenters, geologists, doctors, teachers, electricians, chemists, storemen, public servants, bankers, architects, mariners, seamen . . . American, Swiss, British, Australian, Swiss, British, American, German, French, Italian, Polish, Yugoslav, Dutch, Norwegian, Lebanese, Spanish, New Zealand, Tongan, Fijian, Canadian, Danish . . . People from 37 nations . . . People . . .
PEOPLE...

Thousands of tons of engineering and construction supplies and material, delicate and complex control mechanisms, and massive structures have gone into the Gove Project, but the major factor in its successful completion has been people—people in Sydney and in Gove. These are some of the people.