Department of Industry and Resources

Extract from Economic Assessment Report on the Australian Marine Complex – Common User Facility Infrastructure Expansion using a General Equilibrium Approach

21 June 2005

Note: This is an edited version of the original report. It has been edited to remove sensitive State economic development data only. All data concerning Scenario 1 and Scenario 2 (renumbered from original report) remain intact.

WA Development of Industry and Resources

Executive Summary

Purpose of the study

The purpose of this study is to assess the economy-wide effects on the Western Australian economy of the expansion of the Australian Marine Complex, using a general equilibrium modelling approach.

Modelling scenarios

The following two scenarios covering the period 2005-06 to 2029-30 have been modelled:

- *Scenario 1* simulates the impact of the expansion of the Australian Marine Complex associated with power upgrade, Afloat Refits (Anzacs), Tanker conversion and AWD projects. *Scenario 1* represents a base case in which the minimum impact of the expansion of the Australian Marine Complex can be assessed. Total capital expenditure for *Scenario 1* is $33.6 million.

- *Scenario 2* simulates the impact of the expansion of the Australian Marine Complex in the base case (*Scenario 1*) plus the expansion associated with the infrastructure requirements to meet the Amphibious Vessel ship build project. Total capital expenditure for *Scenario 2* is $71.2 million.

Result summaries

Scenario 1

- Over the entire simulation period 2005-06 to 2029-30, **total** (**cumulative**) increases resulting from the expansion of the Australian Marine Complex are projected to be $731 million (in 2002-03 prices and in NPV terms) for GSP, $94 million for investment, $699 million for private consumption, $841 million for exports and $340 million for imports.
- Average **annual** increases between 2005-06 and 2029-30 (in 2002-03 prices and in NPV terms) relative to the levels without the expansion of the Australian Marine Complex are projected to be $29 million for GSP, $4 million for investment, $28 million for private consumption, $34 million for exports and $14 million for imports.
- For the whole simulation period 2005-06 to 2029-30, on average, there will be about 450 additional jobs in WA.
- Total welfare gain over the period 2005-06 to 2029-30 in Western Australia is projected to be $802 million in NPV terms.
- Over the period of 2005-06 to 2029-30, average **annual** changes in royalties, taxes and other revenues in Western Australia are forecast to be -$0.2 million, $1.1 million and $1.8 million in NPV terms (in 2002-03 prices and pre-Grants Commission revenue effect). Total (**cumulative**) changes in royalties, taxes and other revenues are projected to be -$5.2 million, $27.4 million and $45.6 million, respectively, totalling $67.8 million in NPV terms (in 2002-03 prices and pre-Grants Commission revenue effect).
- The sub-region that is expected to benefit the most from the expansion of the Australian Marine Complex is Perth. Compared to the levels without the expansion, the average **annual** gross regional product (GRP) and the average **annual** employment in Perth are projected to be 0.3% higher and 0.3% higher, respectively.
- The impact of the expansion of the Australian Marine Complex displays a similar pattern in all scenarios. Investment related industries, energy industries and domestic-focused industries are forecast to benefit from the expansion of the Australian Marine Complex, but export-orientated industries are projected to suffer slightly due to the appreciation of the real exchange rate.

Scenario 2

- Over the whole simulation period 2005-06 to 2029-30, **total** (**cumulative**) increases resulting from the expansion of the Australian Marine Complex are projected to be $1626 million (in 2002-03 prices and in NPV terms) for GSP,

$158 million for investment, $1624 million for private consumption, $1499 million for exports and $583 million for imports.

- Average **annual** increases between 2005-06 and 2029-30 (in 2002-03 prices and in NPV terms) relative to the levels without the expansion of the Australian Marine Complex are projected to be $65 million for GSP, $6 million for investment, $65 million for private consumption, $60 million for exports and $23 million for imports.
- For the whole simulation period 2005-06 to 2029-30, on average, there will be about 1190 additional jobs in WA.
- Total welfare gain over the period 2005-06 to 2029-30 in Western Australia is projected to be $1902 million in NPV terms.
- Over the period of 2005-06 to 2029-30, average **annual** changes in royalties, taxes and other revenues in Western Australia are forecast to be -$0.6 million, $2.6 million and $4.1 million in NPV terms (in 2002-03 prices and pre-Grants Commission revenue effect). Total (**cumulative**) changes in royalties, taxes and other revenues are projected to be -$14.8 million, $64.5 million and $103.3 million, respectively, totalling $153 million in NPV terms (in 2002-03 prices and pre-Grants Commission revenue effect).
- The sub-region that is expected to benefit the most from the expansion of the Australian Marine Complex is Perth. Compared to the levels without the expansion, the average **annual** gross regional product (GRP) and the average **annual** employment in Perth are projected to be 0.7% higher and 0.8% higher, respectively.

Economic Assessment of the Australian Marine Complex – Common User Facility infrastructure expansion using a General Equilibrium Approach

The purpose of the study

The purpose of this study is to assess the economy-wide effects on the Western Australian economy of the infrastructure expansion of the Australian Marine Complex – Common User Facility (AMC-CUF), using a general equilibrium modelling approach.

The Australian Marine Complex

The Australian Marine Complex, located in the north-east sector of Cockburn Sound, 23 kilometres south of Perth, is a world-class Centre of Excellence for manufacturing, fabrication, assembly, technology, repair and maintenance servicing activities in the marine, defence and resource industries. The Australian Marine Complex comprises four adjoining precincts (Shipbuilding Precinct, Technology Precinct, Fabrication Precinct and Support Industry Precinct) and two facilities (Common User Facility and Marine Support Facility). The Australian Marine Complex has been developed to facilitate and enhance the opportunities created by the clustering of these industry sectors.

The Australian Marine Complex – Common User Facility has proposed an expansion to its infrastructure over the next three years to meet new demand for its facilities and services generated by a number of projects such as Afloat Refits (Anzacs), Tanker conversion, Gorgon Quarantine, Module Fabrication, new ASC Facility for submarine maintenance and repair, Amphibious Vessels and AWD shipbuilds. Infrastructure items required include power upgrade, Stage 1 wharf berthing upgrades, Stage 2 wharf floating dock integration upgrade, Stage 3 new load out wharf, barge wharf, floating dock and transfer system, blast and paint shop, hardstand areas with cranage and fabrication halls. Total capital expenditure will be $166 million.

The Model

To analyse the likely economy-wide impact on the Western Australian economy of the expansion of the Australian Marine Complex, a new version of the Monash Multi-Regional Forecasting model (MMRF-Green) developed by the Centre of Policy Studies of Monash University has been used. MMRF-Green is a multi-sector dynamic model of the Australian economy covering the six States and two territories. The MMRF-Green model used in this study divides the Australian economy into two regional economies — Western Australia and the rest of Australia. Each of these regions is modelled as an economy in its own right with its own specific prices, consumers,

industries etc. There are four types of economic agents — industries, households, governments and foreigners. There are 85 industries in each region, together producing 88 commodities.

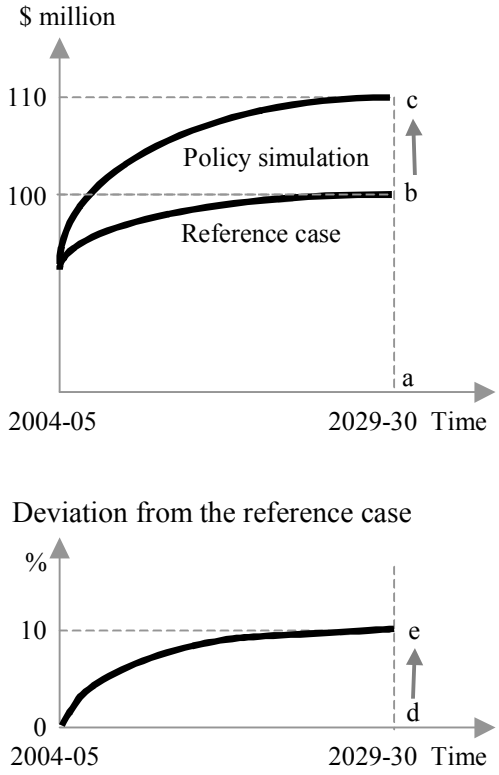
As a dynamic model, MMRF-Green is able to produce sequences of annual solutions connected by dynamic relationships. The MMRF-Green model determines regional supplies and demands of commodities through optimising behaviour of agents in competitive markets. Optimising behaviour also determines industry demands for labour and capital. Labour supply at the national level is determined by demographic factors, while national capital supply responds to rates of return. Labour and capital can cross regional borders so that each region's stock of productive resources reflects regional employment opportunities and relative rates of return

Interpreting results

To run a dynamic simulation, MMRF-Green has to develop a reference case or a 'business as usual' simulation. The reference case projects the growth in key variables in a region based on business-as-usual assumptions for the economy. In this report, for example, the reference case represents the likely outlook for general economic conditions in the Western Australian economy without the expansion of the Australian Marine Complex the period to 2029-30. Against the baseline provided by this reference case, the impacts of changes in policies or other external factors can be assessed.

The estimated impacts on economic variables of policy changes or external shocks are typically expressed as percentage deviations between the equilibrium levels of those variables in the reference case and their equilibrium levels in the policy simulation. For example, the impact on Western Australian Gross State Product (GSP) of the expansion of the Australian Marine Complex can be identified by comparing the level in the State's GSP in the policy simulation (i.e. with the expansion of the Australian Marine Complex) with its level in the reference case (i.e. without the expansion of the Australian Marine Complex). If GSP in the reference case in 2029-30 is projected to be $100 million and following the expansion of the Australian Marine Complex, GSP in 2029-30 is projected to be $110 million, this corresponds to a 10% increase in GSP from the reference case. Hence, in this example, the effect of the expansion of the Australian Marine Complex would be to increase WA's GSP by 10 per cent compared with the reference case projection at 2029-30 (figure 1).

Figure 1: Interpreting results in MMRF-Green simulations



Modelling the infrastructure expansion of the AMC-CUF

In modelling the potential impacts on the WA economy of the expansion of the AMC-CUF, two scenarios covering the period 2005-06 to 2029-30 have been simulated based on information about demand (or revenues) that is likely to be generated from those projects that have a current interest in using the facilities and services of the AMC-CUF if the required infrastructure is available. These scenarios are as follows:

I. *Scenario 1 — The base case*. This scenario focuses on the upgrade of infrastructure that is required to meet current demand at the AMC-CUF associated with the Afloat ANZAC refits, tanker conversion and AWD modules. It is also required for the future projects targeted and includes infrastructure such as site works, power and wharf upgrades As the above contracts have been awarded for these projects, *Scenario 1* represents a base case in which the minimum impact of the expansion of the Australian Marine Complex can be assessed. Total capital expenditure for *Scenario 1* is $33.6 million. Once revenue is stabilised, annual income received by the

Australian Marine Complex will be $150 million. The income-generating period in *Scenario 1* is 11 years (2005-06 to 2015-16).

II. *Scenario 2 — The base case plus infrastructure for the Amphibious Vessel ship builds*. This scenario simulates the combined effects of the infrastructure expansion of the AMC-CUF associated with Amphibious Vessel shipbuilds as well as the projects in the base case. Total capital expenditure for *Scenario 2* is $71.2 million (including $27.6 million expenditure on upgrading the launch and retrieval infrastructure associated with Amphibious vessels). Annual revenue generated from Amphibious will be $175 million for eight years (2007-08 to 2014-15).

To assess economic impacts of the expansion of the AMC-CUF, a miniature AMC has been created for WA in the model. This "dummy" AMC is then used to implement the expansion shocks in the simulation.

Major assumptions underlying the simulations are as follows:

- At the national level, the deviation in the national real wage rate from its reference level increases in proportion to the deviation in economy-wide employment from its reference level. Eventually, the real wage adjustment eliminates any deviation in national employment caused by the gas-processing projects. At the regional level labour is mobile between state economies. Labour is assumed to move between regions so as to maintain inter-state wage and unemployment rate differentials at their reference levels.
- The expansion of the Australian Marine Complex will generate no technology change or consumer taste change in the whole economy.
- In deviation simulations MMRF-Green allows for short-run divergences in rates of return on industry capital stocks from their levels in the reference forecasts. Such divergences cause divergences in investment and capital stocks. The divergences in capital stocks gradually erode the divergences in rates of return.
- Consumption expenditure of the regional household moves in line with changes in Household Disposable Income (HDI). HDI is the sum of factor payments (wages and dividends) to Australian residents and government transfer payments (unemployment and other personal benefit payments) less direct income tax. In calculating the change in HDI due to the expansion of the Australian Marine Complex we take account of the income directly generated by the projects, the income indirectly generated via input/output linkages and induced income effects.
- Discount Rate is 5%.

Major economic impacts on the Western Australian economy of the infrastructure expansion of the AMC-CUF

The infrastructure expansion of the AMC-CUF is expected to generate higher investment, employment, consumption, exports and gross state product (GSP). This occurs because the projects increase the production and export capacity, generating direct and indirect demand for labour that in turn leads to higher incomes which increases private consumption potential in the economy. Increases in investment, exports and consumption will lead to higher GSP

Macro economic impact on the WA economy in Scenario 1 (The base case)

In the most conservative scenario, *Scenario 1*, as a result of the expansion of the Australian Marine Complex, Western Australia's GSP in 2029-30 (the end year of the simulation period) is projected to increase by $8 million in net present value (NPV) terms (or 0.01%) compared with the reference level without the expansion. Investment would increase by $1 million in NPV terms (or 0.01%), private consumption by $3 million in NPV terms (or 0.01%), exports by $4 million in NPV terms (or 0.01%) and imports by $2 million in NPV terms (0.01%). There would also be an increase of about 100 jobs, representing a 0.01% increase on the reference case value.

Average **annual** increases between 2005-06 and 2029-30 (in 2002-03 prices and in NPV terms) relative to the levels without the expansion of the Australian Marine Complex are projected to be $29 million for GSP, $4 million for investment, $28 million for private consumption, $34 million for exports and $14 million for imports. The Average increase in state-wide employment is about 450.

Over the whole simulation period 2005-06 to 2029-30, **total** (**cumulative**) increases resulting from the expansion of the Australian Marine Complex are projected to be $731 million (in 2002-03 prices and in NPV terms) for GSP, $94 million for investment, $699 million for private consumption, $841 million for exports and $340 million for imports.

Macro economic impact on the WA economy in Scenario 2 (The base case plus Amphibious vessel ship builds)

In *Scenario 2,* compared with the reference levels without the expansion of the Australian Marine Complex, Western Australia's GSP in 2029-30 is projected to increase by $12 million in NPV terms (or 0.02%). Investment would increase by $3 million in NPV terms (or 0.02%), private consumption by $6 million in NPV terms (or 0.02%), exports by $3 million in NPV terms (or 0.01%) and imports by $3 million in NPV

terms (0.01%). There would also be about 227 additional jobs, up 0.01% on the reference case level.

Average **annual** increases between 2005-06 and 2029-30 (in 2002-03 prices and in NPV terms) relative to the levels without the expansion of the Australian Marine Complex are projected to be $65 million for GSP, $6 million for investment, $65 million for private consumption, $60 million for exports and $23 million for imports. Employment in the State would increase by average of about 1190 persons per annum.

Over the whole simulation period 2005-06 to 2029-30, **total** (**cumulative**) increases resulting from the expansion of the Australian Marine Complex are projected to be $1626 million (in 2002-03 prices and in NPV terms) for GSP, $158 million for investment, $1624 million for private consumption, $1499 million for exports and $583 million for imports.

Impacts on WA Government revenues of the infrastructure expansion of the AMC-CUF

The impact of the infrastructure expansion of the AMC-CUF on WA Government revenue is mixed. The stimulus provided by the expansion will result in larger economic activities in the State. Consequently, revenues from sources such as payroll tax and stamp duty will rise. However, the enlarged local absorption and the upward price pressure caused by the expansion is likely to see some export-oriented industries suffer slightly, hence resulting in a decrease in royalties.

Impacts on the Western Australian Government revenues of the expansion of the Australian Marine Complex in *Scenarios 1 and 2*.

Royalties decrease -$0.2 million per annum (*Scenario 1*) and –$0.4 million per annum (*Scenario 2*). However, increases in taxes[1] and other revenues are forecast to more than offset the loss in royalties. Total cumulative increases in the State Government revenues over the period 2005-06 to 2029-30 are forecast to be $68 million for *Scenario 1* and $153 million for *Scenario 2*.

[1] Taxes include payroll tax, land taxes, other property taxes, stamp duty and other taxes. Stamp duty includes revenues from insurance policies, mortgages, marketable securities, cheques, stamp duty on conveyances and other stamp duty. The assumption underlying the calculation is that payroll taxes will grow at the same rate as nominal wages. In the case of stamp duty on conveyances and "other", these will increase at the same rate as nominal state final demand (SFD). Other taxes grow at between 0.0 and 1.0 times the increase in nominal SFD.

Welfare impacts on Western Australia

As shown by rising private consumption, the expansion of the Australian Marine Complex has a favourable impact on Western Australia's welfare. A better measure of the impact on welfare for the WA population would be the absolute change in household consumption plus public consumption, which would take into account of changes in the royalty payments and other government revenues associated with the expansion of the Australian Marine Complex[2]. As a result of the expansion, total increases in State's welfare in NPV terms over the period until 2029-30 are projected to be $802 million in *Scenario 1* and $1902 million in *Scenario 2*. On average, the State's welfare in NPV terms is forecast to increase annually by $32 million in *Scenario 1* and by $76 million in *Scenario 2*.

Mainly due to investment activities associated with the expansion of the Australian Marine Complex, Western Australia's welfare will increase at the expense of the rest of Australia in all scenarios. For Australia as a whole the welfare impact of the expansion will be negative except in *Scenario 1*. Total increases in welfare in NPV terms in Western Australia over the period of 2005-06 to 2029-30 are projected to be $802 million in *Scenario 1* and $1902 million in *Scenario 2*. In contrast, the rest of Australia is projected to suffer a welfare loss of $796 million in *Scenario 1* and $2184 million in *Scenario 2*. For Australia as a whole, the welfare changes in total will be $6 million in *Scenario 1* and -$282 million in *Scenario 2*.

Impacts on the sub-regional economies of the infrastructure expansion of the AMC-CUF

The MMRF-Green model has a module to disaggregate State results to the Statistical division level. There are ten Statistical divisions in Western Australia in the model, including Perth, Peel, South West, Great Southern, Wheatbelt, Gold-fields Esperance, Mid West, Gascoyne, Pilbara and Kimberley. Impacts of the expansion of the Australian Marine Complex on the sub-regional economies in Western Australia vary depending on the economic structure of each sub-region. It is expected that the region where the Australian Marine Complex resides will benefit the most. During the period 2005-06 to 2029-30, the largest impact occurs in the Perth region. Compared with the levels without the expansion, on average, gross regional product (GRP) and employment for Perth are projected to be 0.3% and 0.3% higher, respectively, in *Scenario* 1 and 0.7% and 0.8% higher in *Scenario 2*. The impacts of the expansion of the Australian Marine Complex on other sub-regions are negligible. However, in more

[2] This slightly underestimates the welfare impact, as the Federal Government surpluses are not distributed for State welfare calculation purposes.

general terms, these regions might receive more funding for major services such as health and education due to increasing government revenue.

Impacts on Western Australian industries' output

Western Australian industry output effects of the expansion of the Australian Marine Complex are reported as the cumulative percentage changes away from the base-case level. For example, if a variable grows by 2% in year one of the reference case and 3% in the policy simulation, the deviation is 1%. If the deviation is 2% in the second year and 0.5% in the third year, then the cumulative deviation is 1% in year one, 3% in year two and 3.5% in year three. The industry results presented are for the real (inflation-adjusted) output of each industry.

Export-orientated industries

As a result of the expansion of the Australian Marine Complex, output from export-orientated industries is forecast to fall slightly due to an appreciation of the real exchange rate, whereby the nominal exchange rate appreciates relative to costs. The additional demand generated (particularly in the construction phase) pushes the aggregate level of prices in the Western Australian economy upward, which deteriorates the competitiveness of the State's traditional exports industries.

Investment-related industries

All investment-related industries are projected to benefit from the expansion of the Australian Marine Complex, particularly during the construction phase. As a key input to business investment, the construction industry and the industry manufacturing structural metal products are expected to benefit the most in percentage terms.

Energy industries

Demand for energy is expected to rise due to the expansion of the Australian Marine Complex. As a result, all energy industries are forecast to grow faster than in the reference case.

Domestic industries

Higher employment resulting from the expansion of the Australian Marine Complex will increase the consumption capacity in Western Australia. Also, the influx of interstate migrants associated with large investment activities in the State will stimulates the demand for financial, education and health services. As a result, Western Australia's

domestically focussed industries such as retail trade, banking, hotel services and health services are forecast to expand relative to the levels in the reference case.