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Memorandum

To: EM Working Group

From: Howard McElderry

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Re: **Updated Analysis of 2016 Cooperative Research Program Budget**

This document is an update to my March 24 memorandum summarizing expenditures for Archipelago portion of the 2016 cooperative research program. As a result of some questions raised we recognized a need to revisit the numbers, this time going through invoice records instead of projections made close to year end. I have updated the table from the 24 March, as well as expanded on some of the points raised earlier.

In this presentation, we've analysed all activities carried out and invoiced in 2016, after removing 4th quarter activities that related to the 2017 cooperative research program. The resulting 2016 program costs were subdivided by expense category (e.g., labor, travel, equipment, etc.) and by type of expense (one-time, recurrent, amortized). The purpose for this separation of expense types is to help estimate annual program costs for an ongoing EM program, recognizing that certain expenses at the beginning of a program only occur once, or are better reflected as an amortized expense. For example, program planning and development costs occur at the beginning of a program and would not be expected as an ongoing expense. Similarly, the installed cost of EM equipment (capital cost plus installation labor) should be distributed over the life of the equipment, rather than the year of installation.

The following Table provides a summary of 2016 program costs for the work carried out by Archipelago, as per methodology outlined above.

Expense Category	Expense Type			Program Total	Adjusted Annual Cost
	One-Time	Recurrent	Amortized		
Archipelago Staff Labor	\$68,400	\$43,981	\$29,198	\$141,580	\$49,821
Field Labor	\$0	\$28,098	\$84,295	\$112,394	\$44,958
EM Products	\$0	\$15,575	\$140,177	\$155,752	\$43,611
Travel Expenses	\$5,259	\$5,259	\$10,518	\$21,035	\$7,362
Misc. Expenses	\$0	\$5,571	\$16,712	\$22,283	\$8,913
2016 Total Costs	\$73,659	\$98,485	\$280,901	\$453,044	\$154,665
2015 Amortized Costs					\$36,385
Total Adjusted Cost					\$191,049

The observations made in the earlier memorandum are still the same although the numbers are slightly different. In this re-analysis of the expenditures, labour was about \$38k lower than projected while travel and miscellaneous expenses were \$7.1k higher, the net effect being about \$30k lower cost.

2016 Analysis

At this stage in the program, the majority (60%) of program expenses have been directed toward building capacity with EM system purchases and EM system (or component) installations on fixed gear vessels in the EM Pool. In 2016, the program saw the addition of 10 full systems and 25 sets of peripheral components, plus assorted spare parts. Moving away from period selection in 2016, 100% of the 26 vessels opting into the EM pool were set up with EM systems. This significant program cost has a carry forward benefit for several years and is therefore an amortized expense. Archipelago generally uses a five year amortization for cost modeling, but we know from experience that equipment life is generally much longer.

The logic for amortizing costs is to spread the expense across the years where the benefit is provided. Hence, these costs persist into the future and grow with each additional year of capacity building (installing more EM systems). For example, the estimated amortized cost for 2015 was \$36k and 2016 was \$56k. Hence, the total amortized cost of \$92k per year should be included in 2017 program cost estimate. Similarly, further EM equipment expenditures in 2017 and 2018 will continue to contribute to the amortized costs and 2019 will likely be on the order of \$200k. Since grant funding was provided to front load the payment for EM equipment, including a budget for amortized equipment costs each year ensures that EM equipment is provided in perpetuity. It is difficult to predict the replacement timeline for EM equipment (we expect longer than five years), or the cost of next generation EM systems, but the method used here is likely conservative.

Recurrent program expenses represented the second largest expense type. This is the estimated annual operating cost of the program at the current capacity of deployed EM systems without growing or replacing EM equipment pool. The estimated recurrent cost in 2016 was \$98k. The deployment method has been evolving over the years (period selection, then trip selection) and other efficiencies are growing so we would expect the daily operational costs to decline over time. There are a number of program design choices that directly influence operating costs which should be examined further through a modeling exercise. It should be noted that, once the capacity building phase of the program has passed, the smaller scale of field staff recurrent costs may require supplementing in some fashion to ensure their availability in low activity ports.

The one-time expenses primarily reflect activities associated with program development that would not be expected to reoccur during an operational program. This includes development of methodology (e.g., score cards, data review, communications procedures, etc.), evaluation of program data, mostly through the EMWG process, and other activities. One would expect the one-time activities to decline and shift toward recurrent operational activities as the final methodology becomes established. One-time expenses would either be considered as a start up cost, independent of program operations, or as an amortized cost, but over a long time frame of a decade or more.

The right most column in the Table provides an estimate of the adjusted annual cost. The adjusted annual cost takes the full recurrent cost and 20% of the amortized cost to provide an estimate of the annual cost of an operational EM program. One-time costs are considered a start up cost and have been ignored. We have also incorporated the \$35k amortized cost carried forward from 2015 program year. Using this approach, the adjusted annual cost of the EM program is about \$190k and the ongoing (recurrent) cost is

about \$98k. Going forward to 2017 with the addition of more EM systems, more vessels, and correspondingly more days monitored, the adjusted annual cost and recurrent cost are expected to rise.

Typically, at-sea monitoring costs in fisheries are reflected as a cost per seaday. The cost per seaday of the EM program can be estimated by dividing the number of seadays completed by the adjusted annual cost. Based on data summary information from PSMFC, the 26 vessels in the EM Pool realized a total of 357 monitored seadays (25 vessels, 77 trips, 537 hauls) for the fishing trips where EM systems were in operation. This translates to an average cost per seaday of \$535 using adjusted annual cost and \$276 using the recurrent program cost. We understand from PSMFC that data analysis costs were about \$40k for the 357 days monitored, or about \$112 per seaday. Incorporating this number, we estimate the 'all in' monitoring cost to be \$637 using the adjusted annual cost and \$388 using the recurrent cost method. These revised rates are about \$30 per seaday lower than presented in the 24 March memorandum. These rates do not incorporate lost opportunity as a result of equipment being in place but the vessel not selected for monitoring (i.e., there could have been more monitored days at sea at little or no added program cost).

The categories of expense used in this analysis do not reflect the service categories (e.g., program coordination, equipment services, field services, etc.) discussed by the budget working group because the accounting framework to support this was not set up in this fashion for 2016. Going forward, we still suggest that program cost reporting be carried out using these service categories.

For those interested to know why the discrepancy between projected in the 24 March memo and the actuals reported here, a little background information is needed. Archipelago began 2016 with a total budget of \$722k for the cooperative research program expecting that all funds would be used in the 2016 calendar year for the 2016 program. What actually transpired was the 2016 program was under-budget and a remaining portion (~\$270k) was either spent in 2016 for the 2017 program, or carried forward to 2017 to be used for the 2017 program. As we realized this eventuality in the 3rd quarter of 2016, we began building projections for these three categories (i.e., 2016 program expenditures, 2017 program expenditures in 2016 and 2017 program expenditures to carry forward to 2017) to enable 2017 budget planning and also to estimate 2016 EM program costs. We did not see a need to update the projections with actual expenditures until people began trying to reconcile amounts expended with the various source budgets.