

**Deep Seabed Mining – Payment Regime Workshop (PRW) #3**  
**Singapore**  
**April 19-21, 2017**

The Payment Regime Workshop series is focused on exploring the key elements of an International Seabed Authority (ISA) payment mechanism and the broader financial regulations that would apply to exploitation contracts for polymetallic nodules. Payment Regime Workshop #3 provided an opportunity to introduce a working financial model to a group of stakeholders and understand how it can assist the ISA in developing a payment regime. In addition, participants explored additional issues important to consider in the development of a payment regime over the course of the workshop, including environmental considerations, risk and cost allocation, different royalty regime approaches, and attracting technology development and innovation. At Payment Regime Workshop #3, participants represented a diversity of stakeholder perspectives. A participant list is included in [Appendix A](#). Action items identified during the workshop are included in [Appendix B](#).

A memo for the group's consideration, sent by Michael Lodge, Secretary General of the ISA, was shared with participants at the beginning of the meeting. In the memo he emphasized the value of building consensus around the parameters for a financial model. He specifically drew the group's attention to "the idea that the payment regime should be simple and pragmatic, and should provide a relatively long period of stability for first movers, but should also make provision for review in the light of experience and in order to provide adequate protection for the common heritage of mankind." The model will help interested parties "better understand the dynamics of a deep seabed polymetallic nodule harvesting operation" and "explore the impact of different alternatives for making payments to the Authority, as well as to understand the impact of regulatory and other costs on mining operations." During a brief discussion a participant stated a working financial model is needed for ISA to develop payment mechanism alternatives for LTC consideration as they make recommendations to the Council and other interested parties. Ambassador Karen Tan, Singapore, welcomed meeting participants to Singapore and highlighted the importance of intersessional work, such as this workshop, as key to developing the building blocks of the Exploitation Code.

#### **DSM Payment Regime Developments to Date**

Chris Brown, consultant to the ISA, provided an update on efforts to date to develop the Exploitation Code, which include: a [zero draft of exploitation regulations](#) and review of stakeholder comments on the draft; a [discussion paper](#) on the development of environmental regulations and a March 2017 workshop in Berlin to discuss environmental issues; the upcoming jurisdictional competence and liability and risk working groups; as well as the reports and products from this Payment Regime Workshop series.

Looking forward, the exploitation regulations will be revised based on comments already received from stakeholders and the LTC and combined with environmental regulations. An updated package will be re-issued to the LTC in August 2017 for consideration. At that time, inspectorate provisions, guidelines, and templates will also begin to be developed to complete a comprehensive Exploitation Code package, which will include financial terms.

Mr. Brown also discussed the objectives and principles of the payment regime and outcomes of previous discussions and workshops. Annex III, Article 13 of the United Nations Convention on the Law of the Sea (UNCLOS) identifies guiding objectives for financial terms of contracts, which include: ensure optimum revenues for the ISA from the proceeds of commercial production; attract investments and technology to exploration and exploitation; and ensure equality of financial treatment and comparable financial

obligations for contractors. Section 8 of the 1994 Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (the 1994 Agreement) also includes guiding principles that provide the basis for establishing rules, regulations, and procedures for the financial terms of contracts, such as: a fair system; rates of payment should be within range of those prevailing in land-based mining to avoid giving deep seabed miners an artificial competitive advantage or imposing on them a competitive disadvantage; the system should not be complicated and should not impose major administrative costs on the ISA or contractor; and consideration should be given to the adoption of a royalty system or a combination of a royalty and profit-sharing system.

Thinking around the payment regime has advanced through prior efforts and workshops. [Technical Study #11](#) discussed developing an exploitation code and explored potential components of a payment regime. A subsequent [discussion paper](#) in 2015 outlined considerations for developing a payment mechanism and summarized stakeholder feedback related to a financial mechanism. Following discussions at a 2015 [workshop](#) in Singapore, some participants suggested the mechanism should include a transitional regime to encourage investment and growth in the area, a payment that includes a fee and royalty, a review after 10 years, and a focus on stability for the initial years of exploitation. Discussions about the payment regime and financial terms continued at a [workshop](#) in Bellagio in late 2015.

The first Payment Regime Workshop took place at the Scripps Institute of Oceanography, University of San Diego California in May 2016. As summarized in the [final report](#) from the workshop, participants in the workshop settled, at that point, on the value of further exploring two sets of fees, an application fee and a second annual fixed fee referenced in the 1994 Agreement, as well as a transitional *ad valorem* royalty mechanism, which would (initially) start “light” and transition to “full.” After a certain time (to be defined), the prospect of a “light” rate would disappear, as the purpose is to attract investment in the Area and to internalize the “technology spill-over effects” of the first movers. The meeting also included discussions about, *inter alia*, challenges to developing a payment mechanism, and environmental incentives and policy approaches.

A second, smaller Payment Regime Workshop was held in December 2016 in London, England. This workshop focused on the financial aspects of deep seabed mining (DSM) in the Area and worked to build a common understanding of the variables in a financial model, identified variations in operating models across the contractor base, and identified unknowns and sensitivities in financial modeling. A [workshop summary](#) provides an overview of the information shared and discussions that took place during Payment Regime Workshop #2.

Following Payment Regime Workshop #3, the financial model will be shared with the ISA which can use it to model different *ad valorem* royalty, corporate income tax, and administrative tax rates. These results can be shared with the LTC as they further explore a payment mechanism and the financial terms of exploitation contracts.

### **A Working Financial Model: An Introduction and Project Boundaries**

Norm Kaneshiro, UK Seabed Resources (UKSR), presented an overview of the cost-related components that make up the working financial model developed by Global Sea Mineral Resources NV (GSR NV) and UKSR of the exploitation of polymetallic nodules in the Clarion Clipperton Zone (CCZ). The presentation included a flow chart illustrating project phases (i.e., pre-feasibility, feasibility, construction, and production) and how the variables in the financial model relate to provide the internal rate of return (IRR). Companies often use the IRR to compare and make decisions about whether to proceed with a capital project. Typically, if the IRR exceeds the company “hurdle rate,” or minimum rate of return on a

project required by its investor or manager, it can move forward. In addition, Mr. Kaneshiro reviewed the key terms included in the Components of a Financial Model - Glossary of Terminology. Mr. Kaneshiro's [presentation](#) and an [updated glossary](#) are both available on the workshop website.

During the discussion following Mr. Kaneshiro's presentation, participants emphasized the purpose of the model is to demonstrate the costs for contractors if they engage in the early phases of exploitation and how payment regime decisions by the ISA could affect contractors. In response to a question, Mr. Kaneshiro stated the economic circumstances illustrated in the financial model may also help the ISA understand what incentives might help industry move towards exploitation activities.

Separately, the ISA has started to map future organizational needs and estimate costs; they will have a better understanding of their internal resource needs once the Exploitation Code is finalized and, as a result, ISA roles in managing exploitation and enforcing the Code are clearly defined. In the initial stages of exploitation activities, royalty payments are expected to be low and Member State contributions will likely continue to support ISA costs in addition to fees payable to the ISA.

### **A Working Financial Model: Methods, Case Study Inputs, Results, and Discussion**

Kris Van Nijen, GSR NV, provided a detailed review of the working financial model and subsequent techno-economic assessment. The presentation included details on methodology, case study inputs, Monte Carlo risk analysis, sensitivity analysis, and results of the assessment. Mr. Van Nijen's [presentation](#) is available on the workshop website.

Introducing the model, Mr. Van Nijen emphasized he was presenting one model, which represents one case study intended to illustrate interdependencies between variables. It does not represent the financial circumstances for the entire deep seabed mining industry. The model includes 32 variables identified at Payment Regime Workshop #2; the values for those variables included in this assessment represent estimates from GSR NV and UKSR. Mr. Van Nijen encouraged other contractors to share values for each of the variable inputs into the models to strengthen the model results and provide a broader economic picture for the industry. Through his presentation and subsequent discussion, Mr. Van Nijen described the values included in the model and the assessment approach:

- **Production Assumptions:** The model represents a vertically integrated, commercially oriented venture, which includes both extraction and processing. The model assumes three million tonnes of dry metallic nodules are produced each year in a four-metal scenario.
- **Payment Regime in the Model:** Building on the outcomes of Payment Regime Workshop #1 in San Diego, the model assumes a (total cost) *ad valorem* royalty system, and a transition from a "light" royalty rate to a "full" royalty rate after 8 years; the assessment explores the impact of royalties ranging from 0-2%, 2-4%, 4-6%, and 6-8%. (Note: the assessment assumes that any potential royalty payments used by the ISA, such as for contributions to a Seabed Sustainability Fund, an Environmental Liability Trust Fund, or an Environmental Bond, are included in the royalty payment by the contractor to the ISA – in other words it assumes there is one royalty and the ISA decides how to allocate it). Additionally, the model reflects an exploitation application fee of US\$1,000,000 and an annual contract administration fee of US\$100,000.
- **Corporate Tax:** The model assumes a corporate tax rate of 25%, with uniform variability distribution between 20-30%. The (weighted average) tax rate will vary depending on the sponsoring state fiscal regime, where applicable, and that of the country hosting processing operations.

- **Hurdle Rate:** The assumed hurdle rate for this assessment is 18%, as compared to a 15% hurdle rate for land-based mining. Several participants suggested the hurdle rate for deep sea mining of polymetallic nodules could be higher, due to the high level of risk and cost of capital. One participant argued that the lower political risk associated with deep seabed mining compared to onshore mining in some jurisdictions spoke to a lower hurdle rate. Participants indicated that as the industry matures (e.g., after 10-20 years), the hurdle rate would likely decrease.

The assessment's analysis demonstrated the impact of different transitional *ad valorem* royalty rates on the IRR for the case study illustrated in this assessment. The model outputs are fairly robust to changes in metal prices, but deeply dependent on the cost of building and operating the processing plants. The sensitivity analysis showed that processing-related costs are the main drivers of the model. Mr. Van Nijen also noted that the results of the assessment showed that a royalty rate of 2-4% or lower (inclusive of additional payments) would allow a company under these assumptions to meet or exceed a hurdle rate of 18%. Some participants explained that if a contractor's hurdle rate is not met, that contractor will not invest in the activity.

Following the presentation, participants asked questions and discussed the model results. In response to a question regarding the assumption of a vertically integrated system, Mr. Van Nijen clarified that the first contractors to begin exploitation will need to be vertically integrated (either as a single entity or through a consortium) in the value chain. These contractors will need to both mine the nodules from the seafloor and process the material: there is currently not a market for unprocessed polymetallic nodules because independent processing plants for nodules do not yet exist. The assumptions and values in this model represent the economic circumstances for the first contractors with exploitation licenses; assumptions related to vertical integration, costs of capital, and risk will change as additional contractors enter the market. There was broad appreciation of the model and its utility in informing ISA discussions around the impact of different royalty rates and corporate income tax rates on a contractor's Internal Economic Rate of Return, given the assumptions about costs included in the model. One participant highlighted that it may be unlikely to expect that the seafloor harvesting operations will be undertaken by the same entity carrying out the onshore processing.

With respect to the royalty rate, one participant emphasized that unlike copper and nickel sulphides, it is not possible to simply use the nodules' physical characteristics to crush, grind and use flotation to upgrade and produce an intermediate product (i.e., nodules are not in discrete particles that can be separated physically from the rest of the ore using these less expensive processes). On land, it is typical for a copper sulphide or nickel sulphide ore to be upgraded/concentrated at a plant situated in the country where the ore is mined prior to being exported. However, this is not possible for polymetallic nodules and no value-adding processes will be occurring in the international seabed area. As such, it would not be appropriate to apply a high *ad valorem* royalty.

Participants indicated further discussions are needed around ISA operational costs, the Seabed Sustainability Fund, Environmental Liability Trust Fund, and Environmental Bond. In the model it is assumed that all of these, and any compensation to the CHM, will be funded through an annual fee prior to the start of production and out of the royalty payments thereafter.

Following Payment Regime Workshop #3, GSR NV and UKSR will share the financial model with the ISA, which can use the model, with, ideally, additional data ranges from other contractors, to ultimately explore the impacts of different payment regime scenarios. The ISA may also initiate a third-party review

of the model and data inputs. Those different scenarios can be presented to the LTC as they explore, and make recommendations for, the payment regime to be included in the Exploitation Code.

### **Payment Regime for Deep Seabed Exploitation Versus Land-based Customary Regime of Different Countries**

Liu Feng, China Ocean Mineral Resources Research and Development Association (COMRA), provided an overview of China's Deep Seabed Law and position on seabed mining. Mr. Liu noted China insists on the principle of the CHM, supports ISA functioning as an organ to administer the Area, and supports balance between utilization of the mineral resources and protection of the environment. Mr. Liu highlighted several provisions in UNCLOS regarding the payment regime included in Exploitation Code, for example, the payment regime should be fair to the contractor and Authority, within the range of land-based mining, and not complicated. Mr. Liu explored payment regime systems used for mineral resources around the world and suggested two payment regime systems should be offered to provide contractors with a choice: an *ad valorem* royalty system and an *ad valorem* royalty plus profit-sharing system. If an *ad valorem* royalty system is applied, he suggested a 0% royalty rate if the net profit  $\leq 0$ ; 1% if  $0 < \text{np} \leq 10\%$ ; and 2% if  $\text{np} > 10\%$  (for a mature deep seabed industry). Mr. Liu expressed COMRA's preference for an *ad valorem* plus profit-sharing system. Finally, Mr. Liu presented that in land mining, the royalty collected by the government is usually used to search for new mineral resources, protect mineral resources, return and subsidize the immature mining industry, and protect the environment; he suggested the use of the Annual Fixed Fee and the Royalty collected by the Authority should also be set to a certain scope.. Mr. Liu's [presentation](#) is available on the project website.

Following Mr. Liu's presentation, participants asked questions and discussed the information. Participants indicated a profit-sharing royalty mechanism might require contractors to submit additional information about revenue and profit to the ISA (depending on the requirements in the final exploitation regulations), which could increase implementation and monitoring costs for both contractors and the ISA. In his response, Mr. Liu indicated that the Authority should have already obtained enough information to calculate the profit. In the *ad valorem* system, the amount of production, metal content, metal price, and sales revenue should be clear. From the Annual Report and the audited expenditure submitted to the Authority by the contractors, which are all based on the Internationally Accepted Accounting Standards, the cost and the profit of the exploitation operation can be easily calculated. Therefore, almost no extra administrative costs on the Authority or on the Contractor will occur. One participant also noted the annual contractor fees may be deductible from the royalty payment to the ISA. The Agreement has a provision in item (d), para.1, section 8, which says "An annual fixed fee shall be payable from the date of commencement of commercial production. This fee may be credited against other payments due under the system adopted in accordance with subparagraph (c). The amount of the fee shall be established by the Council."

A participant clarified that UNCLOS and the 1994 Agreement do not establish a fixed cost for the annual fee. In addition, the 1994 Agreement does not require profit-sharing or *ad valorem* royalty systems, or require that multiple mechanisms be created. Instead, contractors may choose between options, if provided (but providing options is not required), and the 1994 Agreement emphasizes the payment regime should not be complicated. The wording of the provision in item (c), para.1, section 8, annex of 1994 Agreement is the following: "Consideration should be given to the adoption of a royalty system or a combination of a royalty and profit-sharing system. If alternative systems are decided upon, the contractor has the right to choose the system applicable to its contract. Any subsequent change in choice between alternative systems, however, shall be made by agreement between the Authority and the contractor." Mr. Liu pointed out that the 1994 Agreement does not say only one system should be set up and suggested the possibilities need to be explored and exhausted at the regulations formation stage.

Another participant highlighted that a profit share regime would increase complexity as it would prove difficult to agree upon between all stakeholders, and as such, would significantly increase the timeframe in which the regulations could be completed. This would deter current investment and prolong the commencement date of commercial production, in turn further delaying any returns to CHM.

The participant also suggested that a profit share regime would be unfair to the private sector Contractors. This is because State Enterprises are not necessarily driven by commercial requirements. Often State Enterprises do not need to generate a profit, rather, they can operate for strategic reasons. For example, some State's may be happy to operate continuously at a loss in order to secure supply of valuable metals from polymetallic nodules. In that case, if there were a profit share regime it would create a situation where such State Enterprises would not pay a royalty to the ISA because they would not be generating a profit. Not only would this reduce the revenues derived by the ISA, it would also be unfair to the private sector operators who must generate profits in the long term to survive.

### **Commodities Market/Pricing**

Ian Potter, Lion City Capital Advisors, provided an overview of the metals market for nickel, cobalt, copper, and manganese, which are evenly distributed across the CCZ. These metals are identified as commodities: goods that are unbranded and easily substitutable. Producers are price takers and have little control over the price of these commodities. They will generally produce until market prices are below short run marginal cost. As a result, competitive positioning is a function of cost of production. For DSM to be competitive, its cost of production needs to be judged against land based mining. While this is not simple for a polymetallic operation (comparing to single mineral miners), it appears that DSM will likely be in the cheapest quartile of nickel or copper producers. Given the long lead times for mine development relative to the physical supply chain and consumption changes, metal prices tend to be cyclical. As the price for the metals increases or decreases, the amount of the resource on the market will also increase or decrease, but on lagged basis. Deep sea mining for polymetallic nodules is more likely to take place now than it was in the past due to improved deep water technology, and changes in the perceived risk of investment. In contrast to land based mining where the primary risk is the scale of the resource, for DSM the primary risk is the availability of commercially proven seabed to surface extraction technology.

For the purposes of valuing resources and production, Mr. Potter recommended using London Metal Exchange prices to benchmark the price for nickel, copper, and cobalt as this is both market convention and reflective of the most liquid traded market for the commodity. Adjustments to the benchmark prices might include quality, location, or the time period for delivery.

When looking at evaluating a long life project, as faced by DSM, it should be noted that prices for these metals tend to be "mean reverting," which means that as the prices increase, production and supply will also increase, driving the prices back down to the mean. Mean prices typically give a reasonable return on capital to the industry. Significant technological changes can also affect a commodity price structure by changing the cost of extraction (and hence returns). An example of this is the way hydraulic fracturing technology has driven down the price of natural gas. Mr. Potter's [presentation](#) is available on the workshop website.

Mr. Potter stated that, if after including the cost of closing, expected revenues are still below marginal costs, some land-based mines will close when metal prices are low, decreasing industry production. A

participant wondered whether DSM operations would also be able to stop production efficiently if metal prices are low.

Participants discussed the price of and market for metals, and the basket of metals included in the in-situ value of nodules. Mr. Potter noted the major metals markets should be able to absorb the entry of copper, nickel, and cobalt from DSM with minimal price impact. The manganese market, however, is a shallow and fragmented market; the impact of increased manganese on the market from DSM is uncertain.

One participant suggested any metal released in processing nodules should be included in determining the in-situ value of the nodule. Another participant highlighted that such a concept would be at odds with standard regulatory practice on land, and that it was important to maintain consistency with land-based regimes, where the royalty is limited to the main metals contained in the ore. It was highlighted that some of the metals may not be economically recoverable, or may only be recovered in a very low percentage. Importantly, it may often be the case that a metal may only be fully recovered at the expense of not fully recovering another metal, or not recovering certain other metals at all. The existence of some metals may also cause the Contractor to incur a penalty when selling to a processing plant or refinery, and this will vary between operators depending upon the process route used in the value chain. If a royalty has to be paid on a large number of metals, then it is arguable that the ISA would also have to provide the Contractor with a reimbursement payment for those metals that are of negative value to a processing plant.

In response to a question regarding the impacts of decreasing supply of metals on land, Mr. Potter stated that as metals become scarcer, the cost to mine those materials on land will likely increase. The most likely outcome is a continuing transition towards technically and/or environmentally risky mines.

### **Additional Aspects of the Cost Model: Environmental Considerations**

Chris Brown provided an overview of the environmental considerations and incentives discussions coming out of Payment Regime Workshop #1 and an introduction to sections of the draft environmental regulations related to environmental incentives. Two principal objectives of environmental incentives are to: reduce the likelihood and magnitude of damage in a cost-effective way; and ensure funds are available, if needed, to compensate for accidental or unanticipated environmental damage (subject to the development of further rules in connection with responsibility and liability). Payment Regime Workshop #1 highlighted potential policy approaches and instruments such as regulation, environmental fees, responsibility and liability, insurance and bonds, and compensation funds.

The working draft of the environmental regulations acknowledge the use of incentives structures, including market-based instruments, to deliver environmental objectives and targets, promote satisfactory environmental performance, and support technology development and innovation (DR 12). The working draft environmental regulations include a provision for a financial guarantee or security (environmental bond), the repayment of which would be conditional on a contractor achieving compliance with the regulations and implementing a closure plan (DR 44). Part XII of the working draft environmental regulations discusses establishing an environmental liability trust fund to implement remedial measures, promote research into mining methods and best available technologies, and fund restoration projects. There may be some overlap in how individuals are envisioning the purpose and objectives of the various funds; Mr. Brown emphasized the need for a clear rationale and goals for any environmental bonds and/or funds established. Mr. Brown's [presentation](#) is available on the project website.

Dale Squires, University of California San Diego, reported on a meeting at the Pew Charitable Trusts in early April focused on financial regimes for DSM and implications for environmental protection. The small meeting, attended by environmental economists and international finance experts, provided an opportunity to review and explore environmental policy instruments and the payment regime, and gain insights from former International Monetary Fund (IMF) and World Bank employees on these issues. Dr. Squires provided an overview of the discussions at that meeting, including key characteristics and basic principles to consider when choosing environmental policy instruments, possible policy instruments for protecting the marine environment, factors to consider when identifying a payment regime, and payment regime options. Dr. Squires' [presentation](#) is available on the project website.

In reporting on the discussion, Dr. Squires clarified that the meeting took a broad approach to survey the available policy instrument options. Several of the options described, such as certification and ecolabeling, may not be feasible in the deep seabed mining context.

In discussion following Dr. Squires' presentation, participants commented on the following:

- **Sustainability Fund, Liability Fund, Liability Insurance:** One participant clarified that the purpose of a Sustainability Fund is unrelated to liability. A liability fund would be established to address gaps, for example, if the entity that caused a problem is not present to address it; the International Tribunal for the Law of the Sea (ITLOS) Seabed Disputes Chamber set out the gaps that exist without a Liability Fund. Another participant suggested that liability insurance could cover all environmental impacts, once the potential impacts are quantified. A participant suggested that the funds should be established according to need and the contributions should not be predicated on the royalties.
- **Area of Impact:** While discussing potential environmental impacts, one participant noted that, although several sites were allotted to different Contractors with exclusive rights for detailed exploration of the seabed resources, it is highly unlikely that mining would take place over more than a couple of these areas in a given ocean. It was suggested this is the result of high capital expenses, operating costs associated with deep seabed mining systems, and the world market for metals. In addition, a participant indicated studies have shown that for polymetallic nodules, the area mined would be much smaller (between 4000 and 12800 sq km depending on the mining rate) than the area allotted to a Contractor (75,000 sq km). In addition, the actual 'contact' area on the seafloor will be still smaller (200-600 sq km / year for different mining rates).
- **Environmental Incentives, Relationship to Metal Prices:** One participant highlighted a concern that environmental policies could slow or discourage industry from beginning production and suggested risks and associated costs should be borne by everyone because the DSM industry benefits everyone. Others suggested that the polluter pays principle should apply. Dr. Squires suggested one consideration is how well market prices account for the full economic value of a product. If, for example, metal prices do not capture the external costs of extracting and using metals, then incentive-based tools can help capture those costs and benefits.
- **Different Royalty Systems:** Through the Payment Regime Workshop series, participants have focused on a transitional *ad valorem* royalty system. There are others who are interested in exploring other royalty systems, such as those that vary with production, prices, or a proxy for profits to better understand the potential benefits and costs. Contractors are interested in confirming a royalty system quickly, so they can move forward with an investment strategy. One participant suggested that given previous discussions and workshops, industry has been operating on the assumption that an *ad valorem* royalty system would be applied, and industry

was anticipating obtaining further clarity on the rate of the *ad valorem* royalty in the immediate future. This participant suggested that further exploration of other royalty systems may be seen as a step backwards and may delay the timing of the exploitation regulations and that if there is a potential delay in the timing of the exploitation regulations, this would detract from investment decisions today.

### **Risk and Cost Allocation: Possible Risks Associated with Deep Seabed Mineral Extraction**

Samantha Smith, Blue Globe Solutions, gave a presentation on the types of environmental events related to DSM that should be considered, including worst-case scenarios, how they might be addressed, and potential tools to manage risk. Dr. Smith reviewed three different impact categories: permitted impacts, which are identified during the Environmental Impact Assessment (EIA) process and permitted through the exploitation contract; non-permitted impacts, which are environmental impacts that exceed what was predicted or permitted; and accidental events, which includes events caused by natural hazards. Industry environmental management measures and regulations (e.g., emergency orders) can help to minimize and deal with permitted and non-permitted impacts.

The risk posed by accidental events is not as severe for the DSM industry as it is for the offshore oil and gas industry. For example, seafloor minerals are not a flammable resource, like oil and gas, and the volume of a resource spill is limited to the volume of a riser. A spill of material can release sediment, rocks, and water, which can cause localized and likely short-lived plumes. A worst-case scenario event, such as a collision between a production vessel laden with fuel and a transshipment vessel laden with fuel that causes both vessels to sink, is unlikely, but would pose risk to environment and safety. An event like this is not substantially different from other vessel operations that include ship-to-ship transfers, and is already covered by existing insurances. Dr. Smith's [presentation](#) is available on the project website.

Following Dr. Smith's presentation, participants discussed the roles of insurance and bonds, liability funds, and potential environmental events. One participant clarified that insurance or bonds are used when the effects of an operation are greater than expected (e.g., non-permitted impact); for example, if a plume is bigger than expected or travels into another contractor's licensed area. A liability fund could be used in situations when a bond or insurance fails. A participant suggested developing a matrix that identifies risks of concern and the appropriate tools to address each risk. One participant reminded the group to focus on the primary goal of establishing guidelines and procedures at the outset that minimize and, where possible, avoid environmental damage.

One participant suggested there should be either a Bond system or a Liability Fund, but not both. The example of the Western Australia Mining Rehabilitation Fund was raised, which is a Fund that is designed to replace the bond system. That is, the fund is not in addition to bonds, but rather those companies who transition to the trust fund system are able to have their bonds retired.

Regarding risks associated with DSM, a participant also noted that a sediment plume may not be short-lived, and could potentially have adverse impacts on species present in the affected area. Another participant suggested new scientific information regarding sediment plumes is emerging indicating a more limited duration of its effects. A participant also asked about risks related to human health and safety. Dr. Smith indicated assessments and conventions already exist on these issues, but the ISA may want to conduct a review of human health and safety to identify any potential gaps and assess the need for supplementary rules.

### **Royalties: An Introduction**

Chris Brown provided an overview of royalty mechanisms, including the *ad valorem* royalty, profit-based royalty, a hybrid royalty and tax system, and a resource rent tax. Moving from the *ad valorem* system to the resource rent tax system, administrative complexity increases, ISA revenue stability decreases, economic efficiency increases, the opportunity to share in the profit (assuming it can be determined) increases, and transparency challenges increase.

Mr. Brown noted that through previous discussions at Payment Regime Workshops #1 and #2, discussions focused on the benefits of a transitional *ad valorem* mechanism, which can provide economic incentives to attract investment, can be audited for verification of revenues (whereas auditing profits would be more difficult), and has a lower cost to administer relative to other mechanisms explored. Alternative mechanisms, such as those listed above, were explored and may be appropriate to consider as a long term option in the future. Although the workshops have been consistent in discussing the *ad valorem* transitional mechanism, the Council, based on LTC recommendations, will ultimately determine the appropriate mechanism and parameters. If the transitional *ad valorem* mechanism is selected, a review of the mechanism will likely take place in the future, once a specific criterion or pre-identified trigger has been reached, such as a financial milestone or a certain time period. That review mechanism and process may be built into the Exploitation Code. The 1994 Agreement does not specify when this review will take place, but does identify it. Participants emphasized that stability and predictability are required to help industry get started. Mr. Brown's [presentation](#) is available on the project website.

### **Breakout Group Discussions**

Participants split into three groups to discuss pre-defined topics in detail. An overview of outcomes from each breakout group and the subsequent discussion in plenary is included for each topic below.

#### ***Breakout Group Discussions: Topic One – Model Review***

This group explored the assumptions and results of the financial model, discussed the implications of those assumptions and results, identified communication needs, and suggested areas additional models might explore in the future.

Reporting on their discussion, the group indicated the model is a valuable tool to share with the ISA and LTC to use as a vehicle to explore the impact of different royalty rates and corporate income tax rates on a contractor's Internal Economic Rate of Return given the assumptions about costs included in the model. During their discussion, the group undertook a preliminary exploration of some of the model assumptions and impacts of changing those assumptions in the model, such as the production rate, basket approach to valuing nodules, changes in metal recovery rates, and corporate tax rates. In the model, small changes in revenue, capital expenditure (CAPEX), operational expenditure (OPEX), and the payment regime can affect the viability of the operation.

The model currently represents the financial circumstances for one contractor, a first mover, operating in a vertically integrated system and includes exploration, exploitation, and processing. To enable a more robust exploration of the financial implications of a payment regime and royalty system on a variety of circumstances, other contractors, including state-run contractors, will need to submit their data to populate and run the model. In the future, when the DSM industry is more established, contractors may not have responsibility for the full vertically integrated system; a future model may need to be developed to represent a mining-only operation.

Again, one participant highlighted that it may be unlikely to expect that the seafloor harvesting operations will be undertaken by the same entity carrying out the onshore processing. It was also mentioned that the onshore processing and refining/smelting may take place in a number of onshore jurisdictions. There may be many stages involved in the onshore processing, which potentially introduces many additional taxes and taxing jurisdictions. The processing plant may only produce intermediary products which are then shipped to refineries in other jurisdictions. For example, the Contractor may be sponsored by the UK and in addition to paying a royalty to the ISA will pay tax to the UK Government on the profits it derives from its offshore activities and potentially additional fees to the UK Government in return for sponsorship. The processing plant may however be located in Korea (and pay tax to Korea), and the intermediary nickel product may be shipped to China for refining and the intermediary copper product may be shipped to Japan for refining (with such refineries paying taxes in China and Japan respectively). Furthermore, the marketing of such metals may take place in yet another jurisdiction such as Singapore, with associated taxes in that jurisdiction. It would not be practical (and may potentially be impossible) for the ISA to obtain information from those onshore operations. Requiring such information would also likely limit the number of onshore processing plants and refineries that would be willing to engage in this industry, as most processing companies would not be willing to share this commercially sensitive information. This would create an artificial disadvantage for the polymetallic nodule industry because such a requirement is not applicable to land-based mining and processing operations. This would be at odds with how the industry operates and is regulated on land. For example, iron ore is extracted from Western Australia and sold to steel mills in China. The Western Australian government imposes a royalty on the Australian mining companies to compensate for the extraction of that ore. However, the Western Australian government does not (and indeed cannot) seek to obtain information from the Chinese steel mill with respect to the products made by that Chinese steel mill or the revenue/cost profile of that Chinese steel mill.

To ensure the model, including its assumptions and limitations, is well understood, it will be important for a robust explanation to accompany the model and a clear communication strategy to present the information when it is shared with the ISA and LTC. The purpose of the model, key assumptions, explanations of the variables, and the risks associated with the potential income to the contractor, ISA, and sponsoring state will be important to communicate as it is shared. In addition, an explanation accompanying the model should clearly present the corporate tax assumptions, and clarify that the 25% corporate tax shown in the model may be distributed between the sponsoring state and countries where the processing plant is located.

In subsequent discussion of the model, participants recognized the scope of the model is tied to its purpose, namely, to explore the impacts of a payment regime on a first mover. In the future, the LTC may want to develop (a) different model(s) that explores the overall economics of DSM activity and accounts for external costs and benefits of the activity. The ISA may also want to include additional data in the model and to improve its functionality so it can be used to model a wider range of fiscal instruments, such as a profit share, additional profits tax, and royalties that vary with production or prices.

### ***Breakout Group Discussions: Topic Two - Payment Mechanisms***

This group assessed UNCLOS, Annex III, Article 13, and the 1994 Agreement, Section 8, to explore potential payment mechanisms and the rationale behind each. In their report, the group indicated general acceptance that an adaptive and transitional regime is appropriate and noted that, under UNCLOS, the contractor has the right not to accept changes outside the contract. A transitional *ad valorem* approach is appropriate to attract exploitation in the early stages of the industry, when uncertainty and risk are high. Other royalty mechanisms do exist, and different opinions emerged around

the appropriate timing for reviewing or changing the payment regime; for example, from *an ad valorem* system to a profit sharing or hybrid approach.

Different opinions also emerged around the finer details of how a payment regime would be operationalized. Concern was expressed around the complexity of a profit-sharing system and whether it could be fairly applied. Some members of the group continued to express interest in the profit-sharing mechanism, and there was some agreement to continue discussions to identify the benefits and challenges of different royalty systems. Several participants expressed doubt that a profit-sharing system would be implementable in the future, given the challenges with and complexity of implementing it. One participant emphasized that revisiting such concepts would be a step backwards in these discussions and could put current investment at risk, as such investment is being made on the basis of exploitation regulations being adopted in a timely fashion.

Moving forward, the group suggested developing a matrix outlining the different types of royalty systems and usage, as well as an opinion of the relevant terms in UNCLOS related to a payment regime.

### ***Breakout Group Discussions: Topic Three – Attracting Exploitation***

This group focused on questions related to incentives to help contractors make a transition to operating in the exploitation phase given the risks that exist, how to define or identify first movers, the types of incentives that could exist to support first movers and the barriers that need to be avoided, and the importance to contractors of stability, certainty, and predictability.

Reporting on their discussions, the group suggested it would be useful to re-frame the issue around “attracting” exploitation (and avoiding disadvantages to contractors) as opposed to “incentivizing” exploitation. Specifically, they noted the term “attract” is used in UNCLOS, Annex III, Article 13, which indicates the rules, regulations, and procedures related to financial terms shall be guided by the objective “to attract investments and technology to the exploration and exploitation of the Area” (among other guidance). The duration of a payment regime or other policy terms in place to attract exploitation could be defined by mining cycles (e.g., consecutive highs and lows in metal prices); first movers might be those contractors who begin exploitation or obtain an exploitation license within a time period defined by a mining cycle. The time period could be one or two mining cycles after the adoption of the Exploitation Code or the beginning of commercial production. In this scenario, there would not be a limit on the number of contractors considered to be first movers. One participant highlighted the importance of creating a level playing field for potential contractors.

The group also discussed terms that might help to attract exploitation, such as defining a period of stability during which the payment regime will remain unchanged in the exploitation regulations. Recognizing that changes to the payment mechanism may be needed at some point in the future, the ISA should develop clear, pre-defined criteria that must be met to trigger a review and clearly define the review process, so contractors can anticipate when a review might take place and what the process would include. A review may or may not lead to change in the payment mechanism.

During subsequent discussion, one participant highlighted the importance of attracting investment in technology development as well as exploitation. Continued investment in and development of technology may help to reduce environmental impacts and support the transfer of technology to developing States, outlined in UNCLOS Article 144 and Part XIV as a benefit of DSM and a principle governing activities in the Area.

## Additional Discussion

During additional discussion, participants identified and explored the following topics of interest:

- **Benefits, Costs, and the Payment Regime:** In responding to a question regarding fairness of a payment regime, participants identified differences in what is considered fair for contractors, the ISA, and CHM. One participant highlighted the need to explore the costs and benefits of exploitation to the CHM, including external costs such as environmental impacts. To effectively account for external costs, it is possible the payment regime may need to include a high royalty rate, and the appropriate incentives to attract exploitation may not exist. One participant suggested that a discussion of “acceptable” environmental impacts and returns to the CHM might be a more effective way to think about fairness. One participant noted that DSM can be considered to benefit all mankind by increasing the global availability of metals. Another noted that just as there is a hurdle rate for contractors, there may be a “threshold rate” for Member States (i.e., a minimum rate of financial return required to offset increased ISA operational costs and environmental impacts and to provide appropriate remuneration for exploitation of resources subject to the CHM). It is important to note that UNCLOS and the Implementing Agreement do not in any way link the CHM to the payments regime. These instruments do not refer to “returns to the CHM” or “compensation to the CHM” at all.
- **Comparison with Terrestrial Mining:** One of the principles of the 1994 Agreement is that financial terms of contracts should not create an artificial competitive advantage for DSM with respect to land-based mining operations or imposing on DSM a competitive disadvantage. One participant noted that terrestrial mining and DSM are in different stages of development; the land-based mining industry has a long history, whereas DSM represents a new industry. Considerations of advantages and disadvantages across the Exploitation Code should take that history and the different stages of development into account. One participant recommended a study detailing the potential impact of DSM on economies that rely on land-based mining.

## Environmental Bonds, Environmental Liability Trust Fund, Seabed Sustainability Fund

The Components of a Financial Model glossary of terms references an environmental bond, environmental liability trust fund, and seabed sustainability fund, defined as follows:

- **Environmental Bond:** A potential financial guarantee or security to secure compliance with environmental obligations.
- **Environmental Liability Trust Fund:** A potential general environmental liability fund to cover any liability gap for environmental damage.
- **Seabed Sustainability Fund:** A potential fund mandated for instance to promote and develop Marine Scientific Research (MSR) in the Area together with capacity building / technical assistance.

As noted above, the financial model presented to the group assumes these payments fall under the royalty payment; additional costs are not associated with these components in the model. Reiterating comments from an earlier presentation, Mr. Brown recommended clearly identifying the specific needs related to managing environmental risk and then identifying the mechanisms, which may be the bonds and funds already identified or some other market-based tools, to address those needs. In addition, he noted a liability working group is expected to spend time exploring these issues in greater detail in a separate venue.

### ***Environmental Bonds***

The environmental bond associated with exploitation was initially considered to cover closure obligations, such as removal of equipment, ongoing monitoring and management obligations, and other obligations yet to be defined. A participant suggested further discussion to define closure obligations included in an environmental bond would be helpful. One participant noted that environmental bonds are standard practice in the terrestrial mining industry.

A bond would be specific to the parameters of contractor operations, and details such as the size of the commercially viable area within the area licensed for exploitation or whether an operation is vertically integrated can affect the bond. The funds associated with a bond covering closure obligations should remain for the duration of the operation, so they are available to cover closure costs when needed. One participant highlighted a jurisdictional limitation, noting that the ISA does not have authority over activities outside the Area. As a result, any bond managed by the ISA would be restricted to exploitation in the Area, and onshore processing activities could not be included.

A bond posted by a regulated entity can ensure and assure performance. One question discussed at the March 2017 environmental workshop in Berlin was whether a bond could incentivize environmental innovation through an associated reduction in the environmental bond.

### ***Environmental Liability Trust Fund***

Intended to cover liability gaps for environmental damage, the structure of and potential uses for the liability trust fund should be clearly defined. One participant highlighted a potential use for the trust fund, as described in the [2011 Advisory Opinion](#) by the ITLOS regarding a potential environmental liability gap. Whereas contractors are liable for the amount of environmental damages, sponsoring States are liable for failures of due diligence and must have appropriate administrative systems to conduct due diligence. When a sponsoring State has performed their due diligence (and therefore is not liable) and a contractor causes environmental damage and is unable for some reason to meet its liability in full, an environmental liability trust fund should be in place to cover that liability gap. Another participant noted that investors are often wary of environmental risks associated with a project, and a clearly defined liability trust fund can help to address that concern.

### ***Seabed Sustainability Fund***

The seabed sustainability fund could be an investment into research, and a clear definition of how the fund could be used and disbursed is needed. One participant suggested the fund could target research and science that helps us work better in the deep sea environment. Another suggested the fund could be used to help some contractors increase their capabilities to meet environmental requirements. Some participants suggested a potential relationship between the sustainability fund and liability fund, and others suggested they should be considered separate funds.

Outstanding questions related to an environmental bond, liability trust fund, and seabed sustainability fund include:

- Does the royalty payment include an environmental bond, the liability trust fund, or seabed sustainability fund (as is shown in the financial model), or will they be separate, external payments? The financial model presented shows that – with the current inputs and data – regardless of whether they are bundled or separate payments, any payments totaling above 2-4% will lead to the IRR falling below the contractor hurdle rate (as per the model). One participant

suggested that if it is not economically viable to engage in seabed mining while paying for necessary environmental and liability costs, it should not take place until such time that it is. Another participant asked how those 'necessary' environmental and liability costs are defined, and who defines them.

- Where does an environmental bond sit? Who holds the money? How do we ensure it is available when needed?
- Are there additional incentive-based tools that can address environmental risk or encourage contractor innovation? Potential tools could include a green tax or a double dividend green tax, which can both incentivize reductions in environmental risk and can help finance innovation (through an activity like an innovation challenge) or finance clean-up activities. An ecolabeling or certification program may not be as successful for DSM due to the separation between consumers and the metals produced.
- Are there lessons or best practices used in existing systems or land-based mining that can be applied to DSM?
- What are the sponsoring state and contractor responsibilities and liabilities associated with environmental risk?
- Whether ISA technical assistance or capacity building supporting Contractor efforts to meet environmental requirements could incentivize Contractor contributions to environmental bonds or other tools?

### **Process for Reviewing and Evaluating Payment Regime**

One issue the LTC will consider regarding the Payment Regime is the process of reviewing and evaluating the payment regime. Recognizing prior discussions regarding an interest in and the benefits of a period of stability to contractors, where the payment regime remains unchanged for a certain period of time, one participant asked whether there are concerns about being locked into a payment regime for an extended period of time given all of the uncertainties and risk. There may be circumstances where a review of actual costs, such as CAPEX and OPEX, and the impacts of the payment regime could be useful to contractors. In addition, the UNCLOS includes a provision that contractors can decide whether to accept any changes. As a result, a contractor could decide not to accept any changes after a review. Provided a period of stability is guaranteed, the ability to refuse any changes to the royalty rate or payment regime exists, pre-defined criteria exist that trigger a review, and a clearly defined process for review is set out, several participants indicated a review of the payment regime after 5-7 years could be acceptable, but highlighted continued concerns about uncertainty. One potential trigger of a payment regime review identified was a change to the weighted average cost of capital (WACC), although how to attain those data would need to be ascertained.

### **Next Steps**

Mr. Brown reviewed next steps in development of the Exploitation Code, including the re-drafting of the draft exploitation regulations in light of stakeholder and LTC comments and the further development of the draft environmental regulations building on the Discussion Paper and discussions at the March 2017 environmental workshop in Berlin. He stated that the current proposal is for a consolidated set of regulatory provisions to be re-issued/presented to the LTC in August 2017 in preparation for the ISA Annual Session, together with, time permitting, highlights from this workshop and the working financial model. The LTC will then consider and propose next steps following their discussions, including a timeline for regulatory development and appropriate recommendations to the Council. Further stakeholder consultation on the draft regulations would follow in due course. Mr. Brown noted that a legal liability working group will also begin framing questions in connection with the development of responsibility and

liability in the Area and that a workshop (currently at a conceptual stage) has been proposed to discuss jurisdictional competencies over activities in the Area.

The Payment Regime Workshop #3 was made possible with support from The Pew Charitable Trusts and the National Oceanic and Atmospheric Administration (NOAA).

## Appendix A: Participants

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## Appendix B: Action Items

Action Items	Who	To be Completed by
1. Post presentations to Workshop website	RESOLVE	COMPLETED
2. Circulate an updated “cost components of financial model” glossary (reflecting updates in Workshop presentation)	RESOLVE, Norm K.	COMPLETED
3. Develop a draft workshop summary to share with all workshop participants	RESOLVE/Steering Committee	COMPLETED
4. Provide comments on the draft workshop summary to RESOLVE	Workshop participants	Fri., June 7
5. Distribute final Payment Regime Workshop #3 Summary via email and website	RESOLVE	Wed., June 14
6. Circulate final integrated workshop report reflecting discussions at Payment Regime Workshop series	Steering Committee (Chris B., Dale S. lead)	TBD
7. Share estimate of ISA operating costs when exploitation is underway	ISA	TBD