



Promoting Cooperative Solutions for Space Sustainability

Links Between Space Resources Development and the United Nations Sustainable Development Goals (SDGs)

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- Secure World Foundation *is a private operating foundation* that promotes cooperative solutions for space sustainability
- **Our vision:** the secure, sustainable and peaceful use of outer space that contributes to global stability on Earth
- **Our mission:** SWF works with governments, industry, international organizations and civil society to develop and promote ideas and actions for international collaboration that achieve the secure, sustainable, and peaceful uses of outer space for the socioeconomic and environmental benefits to Earth

The Sustainable Development Goals

- The “globally accepted and practical definition of sustainable development”
- Adopted by all 193 United Nations Member States in September 2015
- Set goals and targets for achievement by 2030
- Applicable across industry, government and civil society



High-level Drivers of Space Resources Development

- Economic return and/or profit
- Enabling exploration and/or development of space
- Support in-space commercial applications
- Address resource scarcity on Earth
- Stimulate technological innovation

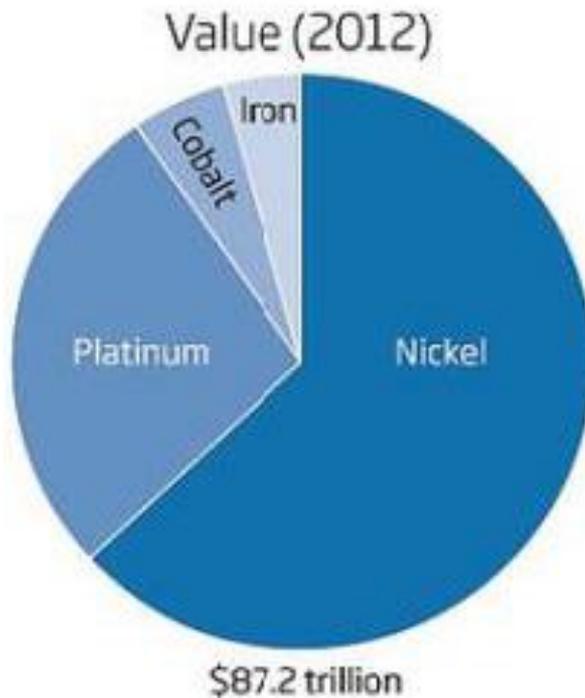
Thematic Elements of SDGs

- Economic Security
 - Affordability
 - Access
 - Economic Growth
- Inclusiveness & Equity
- Sustainability
- Peaceful
- Resilience
- Innovation

Example Case – Reduce Inequality (1 of 3)



“Reduce inequality within and among countries.”



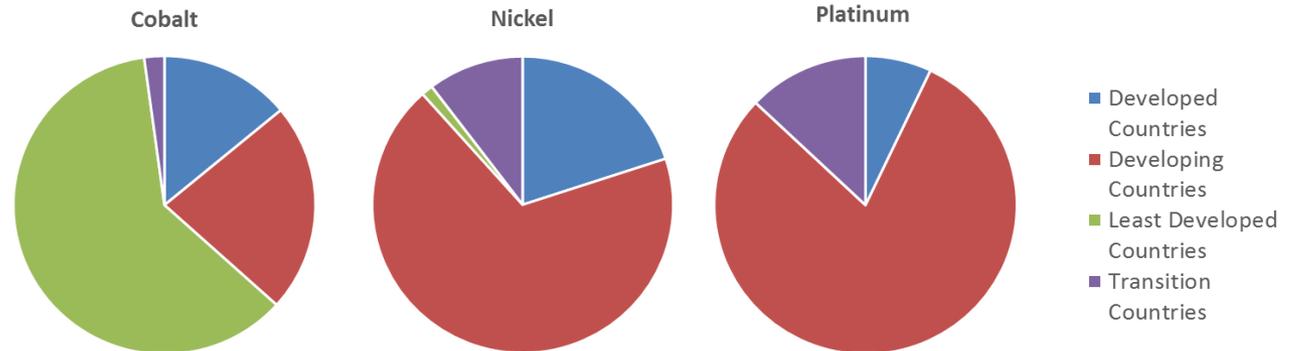
Estimated value (in 2012 dollars) of metal in Asteroid 1986DA

- Celestial objects contain large amounts of precious and non-precious metals with potentially large economic value
- Will resources be used in-space or brought to Earth?
- If brought to Earth: as raw materials or as processed product?
- How will space resources derived materials interact with traditional mining products?
- Distribution of derived economic returns could address economic inequality or contribute to it



“Reduce inequality within and among countries.”

**Production, 2013
by Development
Status**



Source: World Mining Congress, *World Mining Data 2015*

- Traditional mining is concentrated in developing countries – while space resources activities are likely to be lead from the of developed world
- How will space resources impact economic benefit associated with traditional production?

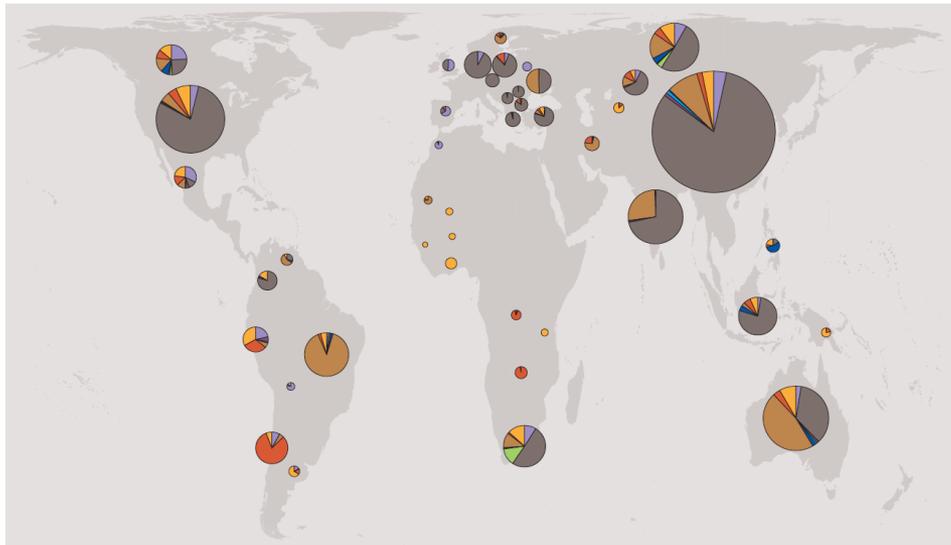
Example Case – Reduce Inequality (3 of 3)



“Reduce inequality within and among countries.”

Global Mining Activities, 2011 (by Total Value of Production)

Metal shares of total value Gold Copper Iron Nickel Lead Zinc PGMs Coal Other



Source: International Council on Mining and Minerals.
Trends in the Mining and Metals Industry, 2011

- Terrestrial mining centers of activity correspond to concentration of expertise in mining operations
- Mining activity – and thus human capital resources – is globally distributed
- Space resources development does not necessarily require centrally located workforce
- How will policy and business approaches leverage existing mining human capital?



“Ensure sustainable consumption and production patterns.”

Waste From An Alaska Platinum Mine



Source: Marc Lisac, Alaska Dispatch News, September 2015

- Societal consumption of resources is not likely to decline in the future
- Mining activities produce waste, and as traditional sources face scarcity, less-efficient extractive processes may increase waste volume
- Space resources development may offer alternative sources and/or change current production and use practices



“Ensure sustainable consumption and production patterns.”

- Shifting of materials extraction and production to in-space approaches offers the potential to reduce environmental pollution on Earth

Objects have been 3D-printed in space from terrestrial materials



Image Source: NASA

...and on Earth from celestial materials



Image Source: Planetary Resources

Production in-space from celestial materials is the next step

Space Resources and SDGs Policy and Business Questions

- SDGs provide a means to link space resources development to socio-economic return; but can that link be reflected in business planning?
- Space resources development offers potential to contribute to economic growth, poverty reduction, and resource sustainability
 - Distributive regime vs. permissive region
 - Tax policy for space resources derived products and materials
 - Impact of space resources on terrestrial commodity prices
 - Trade policy for space resources derived products
- Consistency vs. divergence in national policy and regulatory regimes
 - U.S, Luxembourg, UAE, and others developing national regimes, conditions defined by these regimes will affect what markets, applications and services space resources business plans can address

- The impact of space resources development on the realization of the SDGs will depend on the economic, legal, and policy condition that are implemented
- Business plans and economic returns will be affected by policy and legal regimes relating to the commercialization of off-Earth resources
- Both governments and private enterprise are facing a condition of uncertainty – risk – in defining space resources activities
- There is interest in working jointly to reduce that uncertainty to define market conditions and respect international obligations
- Coordination of national and international law will help states establish the conditions under which socio-economic benefit could result from space-resources development.



THE HAGUE SPACERESOURCES GOVERNANCE WORKING GROUP

- The Hague Space Resources Governance Working Group has been established to respond to this need for coordination
- The SDGs were developed in the spirit of peaceful cooperation
- Achieving them will require coordination and cooperation across the international community
- The Hague Space Resources Governance Working Group can be an element of this global process