Thoughts on Regulatory Mechanisms for Natural Resource Development: Alternatives to Command and Control, Including a Look at Open Source Approaches

By

Stanley Dempsey

Introduction

For many years, Colorado Law has been a leader in research and scholarly work in the areas of law dealing with the use, preservation, and sustainability of natural resources, and has at times, convened numerous experts in those areas. Some of that focus has involved a Center with an outside board and a place at the school.

The recently reenergized Center has adopted a new name, *the Getches-Wilkinson Center for Natural Resources, Energy, and Environment.*

The Center has also declared a new mission statement that reads as follows:

Serving the people of the American West, the nation, and the world through creative, interdisciplinary research, bold, inclusive teaching, and innovative problem solving in order to further true sustainability for our lands, waters, and environment.[1]

This Article explores the fields of law that are the focus of the Getches-Wilkinson Center for Natural Resources, Energy, and Environment, and looks at issues of importance to the global mineral economy. My purpose is to suggest topics for research, teaching, and convening of meetings that have not traditionally been a part of the Center's program.

Background

When Colorado Law Dean Phil Weiser and Brian Dolan first told me about plans for restructuring the Center and asked for my participation in the Inaugural Martz Symposium, I demurred, telling them that I thought some natural resource law conferences were wearing out topics like the Endangered Species Act, fracking, and water allocation. It seems that we have spent much energy fighting the "last war," or the "current war" and that I hoped that the Center might take on some topics that anticipate the "next war."

Dean Weiser and Brian both responded, saying that they hope that the Center would be able to tackle some of the new policy issues being raised by "mines of the future," and by the social, economic, and political changes that are arising out of the application of communications and data managing devices that are becoming ubiquitous. They also pointed out that their access to the Silicon Flatirons Center gave them an edge in working on "the next war." I came away from the conversation feeling that the Center would be innovative and open to taking a look at the institutions of the future.

This conversation coincided with the announcement of Britt Banks as the new Executive Director of the Center. I have known Britt over the years, and I had the privilege to present him with the Corporate Counsel Award at the 2009 Law Alumni Awards Banquet. Britt has a real command of current issues in natural resources development, and I know he will lead the Center with integrity. Thus assured, I gave in, and agreed to write this paper.

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[1] *Getches-Wilkinson Center for Natural Resources, Energy & the Environment*, COLORADO LAW, http://www.colorado.edu/law/research/gwc (last visited Feb. 10, 2014).

The following will first describe how the mining industry works now and what mines of the future will look like. Lawyers involved in developing the institutional framework for natural resource extraction need to know just how large and sophisticated mines of the future will be to really understand what developers are trying to accomplish. This will necessarily focus attention on the game-changing developments in technology that are driving us toward a very different method for extracting minerals.

I am including in this paper a number of links to papers, books, videos and photos that show the new developments in mining. I urge readers to visit the websites and view the videos, as they really tell the story of innovation in mining.

Second, I describe some alternative mechanisms for regulating mine siting and operation, and suggest that these are topics that might be researched by the Center. I discuss *how* to regulate, not *whether we should* regulate. I give examples of alternatives to conventional command and control regulation and make a case for comparative law studies with examples of approaches to mine siting decisions in the United Kingdom and Australia.

Finally, I shine some light on what is becoming known as "open source lawmaking" as it might be applied to natural resources sustainability. The open source approach to problem solving comes out of Silicon Valley. These software developers were among the first to make software code free for anyone to develop and use license-free.[2]

Jake Rigg of Panoptican Policy, a London based policy development and advocacy services consultancy, writes about the origins of "open source lawmaking" as follows:

> The stories of Linux and Wikipedia have become well known. Their success is founded on their 'open source' methods of development: volunteer powered, Internet enabled and geographically dispersed. They embody a new way of creating knowledge that combines an open and democratic ethos with an extraordinary ability to produce work of high quality and on a huge scale.[3]

Rigg recommends the wide application of open methods to areas including law, media, academia and social enterprise among others. Rigg writes that:

> Some of the most important innovations will be in and around the state. Government has started to open up its data sources and more open methods of policy formulation should make it possible to draw on much more of society's intelligence when decisions are being made. Politics is likely to remain dominated by mass communication – but open methods are already beginning to transform the ways in which citizens organize, and even mainstream parties and media organizations are having to learn how to use them. More broadly, as has happened with the web – those cities, organizations and nations that move fastest to embrace open methods in appropriate fields are likely to benefit in all sorts of ways, both economic and social. We argue that other fields have much to learn from open source methods – because they bring into focus principles and working methods, which can be combined in a range of settings to produce better knowledge, goods or services, or make them available on more widely beneficial terms....[4]

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[2] *See* JEFF HOWE, CROWDSOURCING: WHY THE POWER OF THE CROWD IS DRIVING THE FUTURE OF BUSINESS (2009).
[3] Jake Rigg, *Open Source Lawmaking?*, PANOPTICON POLICY (Feb. 9, 2012), http://panopticonpolicy.com/open-source-lawmaking/#.UvlF7fldWVM.
[4] *Id.*

The following is a list of the characteristics that seem to be shared by most major open source projects:

- Transparency
- Vetting of participants only after they've got involved
- Low cost and ease of engagement
- A legal structure and enforcement mechanism
- Leadership
- Common standards
- Peer review and feedback loops
- A shared conception of goals
- Incrementalist – small players can still make useful contributions
- Powerful non-monetary incentives.[5]

I will address below some examples of open source applications in mining, first using the example of crowdsourcing of a mineral exploration opportunity, followed by a crowdsourcing initiative by Planetary Resources and the National Aeronautics and Space Administration ("NASA") to find out how to divert asteroids, travel to them, and ultimately, mine them. Finally, I will consider a number of academic papers that argue that the mining district laws of the California and later gold rushes are early examples of open source law making. I will then consider whether the miner's rules might have application to today's land use issues, like regulation of taco trucks in Los Angeles or solar sites on public lands. (Yes, you read this paragraph correctly, and we are not spoofing!)

The Mineral Economy: Today and Tomorrow

Futurists speculating about mining usually start with population forecasts, and then develop supply and demand models for the various minerals that are used in commerce. They take the work of population specialists, such as those at the United Nations and the U.S. Bureau of the Census, and combine it with estimates of mineral endowment, discovery rates, and changes in extractive technology, to come up with mineral demand forecasts. According to the United Nations, the current population of the planet is 7.2 billion people. The U.N. projects that the global population will reach 8.1 billion people by 2025, and 9.6 billion by 2050.[6]

The United States Geological Survey[7] prepares supply and demand studies. These are very well done, but share with other mineral supply forecasts the limitation that it is very difficult to judge the amount of mineable minerals that may exist in "undiscovered" mineral deposits.

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[5] *Id.*

[6] UN, DEP'T OF ECON. & SOCIAL AFFAIRS, WORLD POPULATION PROSPECTS: THE 2012 REVISION xv (2013), *available at* http://esa.un.org/wpp/Documentation/pdf/WPP2012_Volume-I_Comprehensive-Tables.pdf.

[7] *See* JAMES J. BARRY, GRECIA R. MATOS & W. DAVID MENZIE, U.S. MINERAL DEPENDENCE—STATISTICAL COMPILATION OF U.S. AND WORLD MINERAL PRODUCTION, CONSUMPTION, AND TRADE, 1990–2010 (2013),

There is an ongoing debate in the academic community about whether we are close to running out of some or all commodities. The Club of Rome's 1972 publication "Limits to Growth"[8] continues to be discussed and updated on a regular basis. It is worth doing a search starting with that title, as there is much discussion still going on about the subject of growth and its limits. Peak Oil makes for another productive search.

Today's Mining Industry

Global mining is done by multinational private sector and state owned mining firms. The mining industry also involves vendors of mining equipment, engineering and construction companies, suppliers of materials used in mining and processing of ores, developers of software, and educators and trainers of mining personnel.

Most segments of the mineral industry are dominated by large (and even "ultra-large") mines and processing facilities. Many are surface operations, but some are still underground mines. These mines also have large concentrating or treatment facilities, some operating at rates exceeding 100,000 ton of ore per day. Concentrates go by rail or truck to tidewater, and then by ocean-going vessels to smelters in Japan, China, and Canada. Iron ore goes directly from ports in the Pilbara region of Western Australia—mainly to Japan, China, and Korea—by some of the largest ships on any ocean.

Figure 1. Iron ore from the Pilbara region of Western Australia is shipped to Asian steel plants in very large vessels.

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available at http://pubs.usgs.gov/of/2013/1184/pdf/ofr2013-1184.pdf; *see also* W. DAVID MENZIE ET AL., REVIEW OF SELECTED GLOBAL MINERAL INDUSTRIES IN 2011 AND AN OUTLOOK TO 2017 (2013), *available at* http://pubs.usgs.gov/of/2013/1091/OFR2013-1091.pdf.

[8] DONELLA H. MEADOWS ET AL., THE LIMITS TO GROWTH (1972), *available at* http://www.donellameadows.org/wp-content/userfiles/Limits-to-Growth-digital-scan-version.pdf.

Small mines are mostly in the industrial mineral category, such as sand and gravel, bentonite, and diatomaceous earth. There is increasing interest in mining sand for use in oil and gas "fracking". In contrast, small tungsten, copper, or lead and zinc mines are a thing of the past because there is no place to sell ore or concentrates, and compliance with environmental and land use regulations is not practical for most small operators.

Mines are major consumers of electricity and water. Many are located in very remote areas, and infrastructure development such as roads, rail lines, water storage and transmission, electrical supply, and housing are major costs in constructing a new mine. Important issues facing developers of new mines include:

- Availability of electrical energy and water
- Availability of capital
- Environmental and land use permitting
- Consultation/mitigation of impacts on indigenous people
- Conflict with artisanal miners
- Management of residuals (air emissions, waste rock, tailings, etc.)
- Health and Safety
- Adequate supply of skilled workers
- Remote townsites or camps (Flyin-Flyout camps)
- Resource nationalism

Stages of Mine Development and Operation

The first step in establishing a mine is to either discover a new deposit or redevelop an old mine.[9] Individuals, junior exploration companies, and the staff of major mining companies perform early stage exploration. It is not unusual for a deposit to be found by an individual, and then be vended to mid-size and large mining companies, with the large company ultimately financing and building the mine. Imagination and perspicacity still count in exploration, and the "little guys" play a significant role in finding new mines.

Manufacturers like Caterpillar Inc perform most of the equipment research and development.[10] Private firms like Hazen Research[11] and Kappes, Cassiday and Associates[12] accomplish metallurgical testing and flowsheet design, contracting their services to mine developers. Most environmental and social assessment and mitigation design comes from independent consultants.

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[9] *Mopani Overview*, GLENCORE XSTRATA, http://www.glencorexstrata.com/media/video-library/mopani-overview/ (last visited Feb. 10, 2014) (telling the story of Xtrata's redevelopment of the Zambian Copper Belt).
[10] CATERPILLAR, http://www.cat.com/ (last visited Feb. 12, 2014).
[11] HAZEN RESEARCH, INC., http://www.hazenusa.com/ (last visited Feb. 12, 2014).
[12] KAPPES, CASSIDAY & ASSOCS., http://www.kcareno.com/ (last visited Feb. 12, 2014).

Big mines are financed by the major mining companies like Rio Tinto,[13] BHP Billiton,[14] Teck, Newmont Mining,[15] and Barrick Gold Corporation,[16] using equity raised on the world's stock markets, debt from global banks or international development lenders like the World Bank, and a combination of other financial product like royalties, metal streaming agreements, and equipment financing by vendors. A major mine can cost several billion dollars. Smaller mines are financed by similar sources of capital, as well as by mining specialized private equity firms.

Permitting of a large mine takes five to ten years, and can cost tens to hundreds of millions of dollars. It is rare to have permitting free of challenges by activists of one kind or another.

Large engineering, procurement, construction, and maintenance companies like Bechtel[17] and Fluor[18] sink the shafts, drive the tunnels, and build the concentrators and smelters, power plants, water treatment plants, and port facilities required for a project.

Figure 2. Erecting a new shovel at the Mt. Milligan copper-gold mine in British Columbia.

Mine operations involve technicians, miners, and plant operators. Most are recruited from special groups or locally, particularly at locations where the license to mine involves covenants to hire locally. All personnel are highly trained for their jobs, particularly regarding safety.

Mines can spur economic growth and provide revenue for both local and national governments. Yet, mines also impose profound land use, environmental, and social impacts. Elimination or mitigation of

[13] RIO TINTO, http://www.riotinto.com/ (last visited Feb. 12, 2014).
[14] BHP BILLITON, http://www.bhpbilliton.com/home/Pages/default.aspx (last visited Feb. 12, 2014).
[15] NEWMONT MINING, http://www.newmont.com/ (last visited Feb. 12, 2014).
[16] BARRICK GOLD CORP., http://www.barrick.com/ (last visited Feb. 12, 2014).
[17] BECHTEL CORP., http://www.bechtel.com/ (last visited Feb. 12, 2014).
[18] FLUOR, http://www.fluor.com/pages/default.aspx (last visited Feb. 12, 2014).

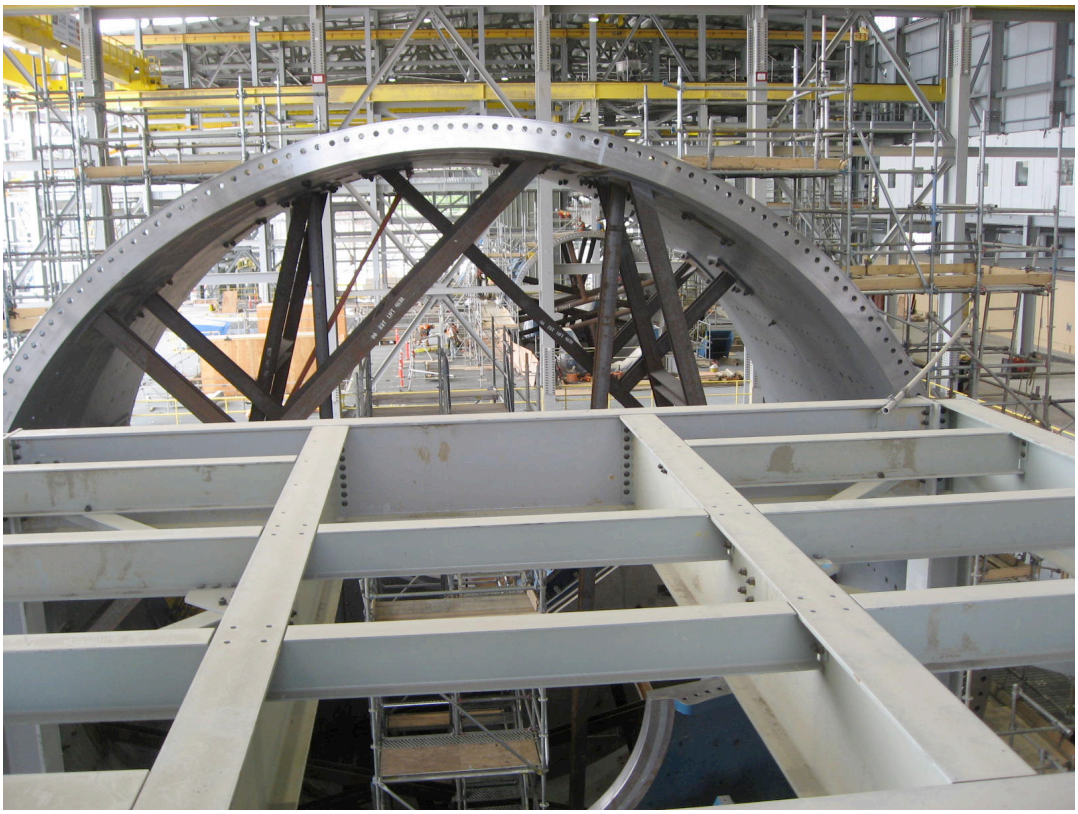

Figure 3. Installing Gears for a Large Mill at the Mt. Milligan Mine in British Columbia, Canada.

negative impacts requires careful assessment of existing conditions, and thoughtful planning, development, and operation. Likewise, securing a proper distribution of mine benefits requires careful attention by the miner and its host governments. International financial institutions impose strict environmental measures in lending agreements. Many operators voluntarily comply with industry codes such as the Cyanide Code[19] or IOS 14001.[20]

Mines of the Future

No matter what our views are about mining and the environment, it seems clear that with nine billion people on the planet, most of whom want access to clean water, electricity, and today's conveniences, a significant amount of mining is necessary. There will be serious efforts to control the impact of mining on competing land uses, the environment, and to meet the demands of governments for a share of the rewards of a mine.

Technology is rapidly and radically changing the mining industry. Some tech advances are incremental, building on big breakthroughs of the past like rock bolting, tunnel and raise boring machines, flotation, the McArthur cyanide process, and heap leaching. Other changes, like the use of drones in exploration, bioleaching to extract metals, and plant wide automation including operator free drills, trucks, railroad trains, and port loaders operated from centers hundreds of miles away, are increasingly novel and true

[19] *The Cyanide Code*, INT'L CYANIDE MGMT. INST., http://www.cyanidecode.org/about-cyanide-code/cyanide-code (last visited Feb. 4, 2014).
[20] *ISO 14000—Environmental management*, INT'L ORG. FOR STANDARDIZATION, http://www.iso.org/iso/iso14000 (last visited Feb. 4, 2014).

game changers.[21] Increasingly, positive attitudes of mine developers and operators toward cooperation with government and the public, genuine efforts to avoid or mitigate social and environmental impacts, and a push towards transparency are also dramatically improving industry performance.

Miners try to prolong the life of a mine by finding more ore, or by converting mineral resources (lower grade mineralized material that is of lower grade, or perhaps with a higher stripping ratio, or which has a more difficult response to metallurgical treatment) into ore by lowering the cost of mining or processing. Eventually, a mine is exhausted and must be replaced. The grades of both existing mines and new discoveries seem to be in decline. This may reflect the fact that most near surface, high-grade mines have likely already been found. New finds may be deeper and of lower grade, requiring more costly processing. In some cases, near surface deposits have been oxidized, or oxidized and secondarily enriched, so that the metal is easier and cheaper to extract. Yet, not all new deposits will necessarily be of lower grade. Relatively recent discoveries of mines like Olympic Dam in Australia,[22] and the diamond mines of Canada,[23] show that there are still new types of high-grade deposits being found in places not previously thought to be prospective for mineral deposits.

Miners have been successful in overcoming the trend toward lower grade ores. Ever larger trucks and shovels, along with improvement of concentrating techniques and the upsizing of concentrating equipment continue to lower the cost of operations through economies of scale. Just as miners reached the limits of improvement in that direction, they began to realize the benefits from automating mining equipment and process control. Mining deeper deposits often requires more complicated and costly methods. The cost of ventilation, dewatering, and transporting miners increases with depth. On the other hand, the rapid development of automation of underground operations offers the promise of dramatically lowering the cost of mining.

Exploration is benefitting from the explosion of technology that makes the work of the geologist easier, faster, and far less expensive than just a few years ago. Global Positioning Systems devices and improving Geographical Information Systems[24] have leveraged the productivity of geologists. A truly major development is the application of Unmanned Airborne Vehicles ("UAV's") or "drones," as a tool for exploration. It is not hard to imagine the many applications of drones to exploration. The idea of mapping sides of mountains from drones is appealing. It might also be handy for sending a six pack up to drillers at a remote site (for consumption off shift, of course). Here are some links to papers and videos of some of the applications of UAV's in mineral exploration.[25]

While we are on the subject of exploration, I want to tell the story of a very successful open source effort undertaken by Rod McEwen, a mine promoter and developer, who used the internet to find more ore in

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[21] *See Drones help Yukon prospectors find new gold deposits*, CBCNEWS (Sep. 4, 2013), http://www.cbc.ca/news/canada/north/drones-help-yukon-prospectors-find-new-gold-deposits-1.1386299 (video of prospectors using drones).

[22] BHP BILLITON, OLYMPIC DAM EXPANSION EIS, http://www.bhpbilliton.com/home/aboutus/regulatory/Documents/Olympic%20Dam%20Supplementary%20EIS/Information%20Sheets/Olympic%20Dam%20EIS%20Mining%20And%20Processing.pdf (last visited Feb. 10, 2014).

[23] *Our operations*, DOMINION DIAMOND CORP., http://www.diavik.ca/index_ouroperations.asp (last visited Feb. 10, 2014).

[24] *See* Karl Jenner, *Introduction to GIS (Geographic Information Systems)*, YOUTUBE (Apr. 4, 2008), http://youtu.be/z5s8kbEdB68.

[25] *See* CBCNEWS, *supra* note 21; *UAVs—Mining's Eye in the Sky*, MINING-TECH. (July 24, 2009), http://www.mining-technology.com/features/feature60074/; *see also* Barbara Wilcox, *Self-Flying Planes Aid Geothermal, Scientific Exploration*, USGS (Sept. 4, 2013), http://www.usgs.gov/blogs/features/usgs_top_story/self-flying-planes-aid-geothermal-seismic-exploration/?from=title (video of a joint program of the National Aeronautics and Space Administration and the United States Geological Survey using drones to test geothermal features).

the existing workings of the Red Lake Mine in Ontario. Named the "Goldcorp Challenge,"[26] the program involved digitizing the entire mine's geological data and putting it on the Internet. McEwen challenged geologists everywhere to use the data and devise new ideas for places to look for additional ore in an existing vein type underground mine. The Goldcorp Challenge sponsored $575,000 in prize money with the first prize of $95,000 going to a Perth, Australia-based mining, geological, and software firm. The Challenge web site received more than 475,000 hits and over 1,400 online prospectors from fifty-one registered countries.

Most importantly, the ideas produced in the Challenge found new ore. Of the top five entries, four commenced drilling operations and each of these struck gold.[27] This is a great example of an open source approach to problem solving. Thus, the story is relevant to the discussion of open source lawmaking below.

Once found, a new deposit must be assessed, plans for mining and further treatment developed, and the project financed and constructed. Dramatic improvements in computing power and software now make it possible to develop ore reserve calculations of high quality very quickly. Likewise, economic assessments and mine plans can be cranked out rapidly.

New automation systems for the mining itself may be the most dramatic and useful of the new technologies being developed. Rio Tinto, the world's second largest mining company, is applying automation of its open pit iron ore mines in the Pilbara region of Western Australia. It has already moved more than 100 million metric tonnes of ore and waste, all with driverless trucks controlled from a special headquarters in Perth, 744 miles from the mine.[28]

Rio Tinto plans to have more than 40 trucks operating autonomously by early 2014. It also expects to include drills and trains that carry the iron ore to ports on the Indian Ocean. A Rio Tinto video provides an excellent explanation of their autonomous mining program.[29]

Automation of underground mining is also a game changer. Mining underground without exposing people to that environment brings great rewards of safety, health, and lower costs.[30]

Processing plants and rail transportation are also benefitting from development of sensors and instrumentation that will continue to reduce work force and give better recoveries.[31]

New technology is also bringing undersea mining closer to reality. Nautilus Minerals is currently pursuing a project with the government of Papau New Guinea.[32] The project is currently the subject of much controversy, including difficulties surrounding the joint venture agreement with the government of Papua New Guinea and opposition from environmental activists.

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[26] *US$575,000 Goldcorp Challenge Awards world's first 6 million ounce internet gold rush yields high grade results!*, GOLDCORP (Mar. 12, 2001), http://www.infomine.com/index/pr/Pa065434.PDF.
[27] *See* Linda Tischler, *He Struck Gold on the Net (Really)*, FAST CO. (May 31, 2002), http://www.fastcompany.com/44917/he-struck-gold-net-really.
[28] *See Rio Tinto - Mine of the Future*, YOUTUBE (Feb. 23, 2012), http://youtu.be/Col_MPuELfA.
[29] Frik Els, *Rio Tinto's robot army*, MINING.COM (Sep. 14, 2013), www.mining.com/video-rio-tintos-robot-army-83874/.
[30] *See Sandvik Automine The New Era*, YOUTUBE (Oct. 31, 2012), http://youtu.be/tkdAYM_nZMA.
[31] *See* W. BAUM, N. O. LOTTER & P. J. WHITTAKER, PROCESS MINERALOGY - A NEW GENERATION FOR ORE CHARACTERIZATION AND PLANT OPTIMIZATION (2004), *available at* http://www.solomineria.com.pe/html/congresos_sme/04/04-12.pdf.
[32] *See* NAUTILUS MINERALS, http://www.nautilusminerals.com/s/Home.asp (last visited Feb. 10, 2014); *see also Nautilus Minerals*, VIMEO (Jan. 27, 2014), https://vimeo.com/85364387.

Figure 4. Planetary Resources plans to mine asteroids in space. They have teamed up with NASA in a crowdsourcing project to develop ways to deflect asteroids that threaten the earth, and to extract metals like platinum from asteroids.

Now, if you really want to "think outside of the box," consider the proposal of a group promoting mining in space. Here is a link to the website of Planetary Resources, a firm organized by celebrities like Eric Schmidt, CEO of Google, James Cameron, Director of *Titanic* and *Avatar,* and Sir Richard Branson of Virgin Atlantic Airlines.[33]

Innovations applying new technology are making a real difference in mining. That is also true of the environmental management side of the business. The same developments in drones, sensors, communication, and computing that are helping miners are also aiding regulators in monitoring and controlling the release of mine residuals.[34]

In concluding this survey of the technical and operating features of mining now and in the future, I suggest that the Center include, where appropriate, papers on how things work. A conference on solar power would benefit from an update on technical and operational developments in that field. Likewise, if Planetary Resources Inc. gets off the ground, it would be nice to have their Luke Skywalker give a talk on how to get to and mine an asteroid.

Reforming the Institutional Framework for Sustainable Mining

The second part of this paper addresses natural resource policies, and the institutional and regulatory framework required to achieve sustainable mining. I use the phrase "institutional and regulatory

[33] Mike Wall, *Asteroid Mining Venture Backed by Google CEOs, James Cameron Unveiled*, SPACE. COM (Apr. 23, 2012), http://www.space.com/15395-asteroid-mining-planetary-resources.html.
[34] *See* Lindsey Harriman & Joseph Muhlhausen, *A New Eye in the Sky: Eco-Drones*, UN ENV'T PROGRAMME (May 2013), www.unep.org/pdf/UNEP-GEAS_MAY_2013.pdf.

framework" here, to refer broadly to all aspects of the regulatory regime that governs relations between miners and host governments, miners and their neighbors, and miners and other stakeholders. I start with laws like the General Mining Law of 1872 ("the 1872 Mining Law"), the Clean Air Act, the Mine Safety and Health Act, and the National Environmental Policy Act ("NEPA"). I continue by discussing more innovative regulatory schemes that have been crafted to deal with issues not effectively dealt with by the traditional framework.

The Mining and Metallurgical Society of America produced a video describing how the U.S. created an institutional framework, which allowed mining to become a major national and international industry in the period from the post-Civil War era until the beginning of World War I in 1917. [35] It describes how geologists and mining engineers, many of whom were trained at the leading mining schools in Europe, created the institutions required for industrialization, such as mining laws, specialized mining schools, a mining press, mining libraries, mining statistical services, state and national geological surveys, and learned societies where mining knowledge could be shared among practitioners of mining arts and sciences.[36] It also conveys the story of mining leaders lobbying for adoption of mine safety and health regulations and a federal Bureau of Mines to carry out safety research and to assist the industry in its quest for better mine conditions.[37] Many of the top mining people of that era can be viewed as being sympathetic to conservation, or wise use, that we identify with President Teddy Roosevelt. Professional foresters, who brought conservation practices to the nation's forestlands through creation of the U.S. Forest Service, were supported by the mining industry, including firms like Homestake Mining Company in South Dakota, who pushed for conservation and scientific management of the forests that provided their boiler fuel and mine props.[38]

Laws governing the use of public lands, and the initial regulation of air and water pollution resulting from mining activity were a start, but by the middle of the twentieth century, it became clear that more should be done to protect land and water. State and federal governments enacted major environmental control and reclamation laws in the 1960s and 1970s, adopting institutional arrangements much more sophisticated and costly than those described by the Mining and Metallurgical Society of America.

The institutional arrangements now in place have secured some of the goals of mining with less negative impacts, but it has come at a very high price for miners and consumers of mine products. Laws and regulations of general applicability are not always the best way to deal with an industrial activity like mining. More particularly, command and control style regulation creates time delays, causing uncertainty that is harmful to both the project proponent and the public. Command and control regulation is sometimes hard to change, particularly when such regulation is embedded in a land tenure law, where flexibility to adapt to changing technologies is sometimes in conflict with the conservatism of property law principles.

Mining professionals, environmental specialists, and lawyers have been relatively effective in developing private or mixed private/governmental regulatory mechanisms that can be used in a particular mining project, such as: (1) organization of mine transportation and drainage districts, and other joint use of

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[35] *A Brief History*, MINING & METALLURGICAL SOC'Y OF AM. http://www.mmsa.net/HistoryVideo/Large/LargeVideo.html (last visited Feb. 10, 2014).
[36] *Id.*
[37] *Id.*
[38] *See* Stanley Dempsey, *Forest Service Regulations Concerning the Effect of Mining Operations on Surface Resources*, 8 NAT. RESOURCES LAWYER 481 (1975) [hereinafter Dempsey, *Forest Service*]; Stanley Dempsey, *Cautious Support: Relations Between the Mining Industry and the Forest Service, 1891–1991*, *in* THE ORIGINS OF THE NATIONAL FORESTS: A CENTENNIAL SYMPOSIUM (Harold K. Steen ed., 1992), *available at* http://www.foresthistory.org/Publications/Books/Origins_National_Forests/sec7.htm [hereinafter Dempsey, *Cautious Support*].

infrastructure arrangements,[39] (2) stock exchange listing standards that require disclosure of exploration results (the JORC Code[40] and Canada's 43-101 reporting[41]), including certification of mining professionals as "Qualified Persons,"[42] (3) voluntary adoption of industry best practices, e.g. the Cyanide Code,[43] ISO 14001,[44] and LEED,[45] and certification of compliance with those codes, (4) ad hoc collaborative environmental planning of mines that take into consideration local needs and wants, particularly in situations where governmental regulation is seen as inadequate,[46] and (5) adoption of special national, state or provincial legislation dealing comprehensively with infrastructure, security, and operation of a particular mine.[47]

Mining companies sometimes join forces to work on issues of sustainability. The largest mining firms support the International Council of Mining & Metals. Based in London, it works with other international organizations on a wide variety of issues, ranging from artisanal and small-scale mining, to the study of sustainability footprint.[48]

The big regulatory issues for the global mining industry are (1) resource nationalism and (2) time delays arising from agency bias or ineffectiveness and/or opposition by NGO's and local interests. On average, it takes five to ten years to permit a mine. Thus, one could question how well the process works.

Regulatory reform is a topic of considerable interest to governments, the regulated community, and legal scholars. There are a number of topics that the Center might consider for research, teaching, and convening. In recommending topics to the Center, I want to make it clear that I do not consider whether there should be any regulation in general. I am not advocating to change laws like NEPA to make it easier for a miner to get a permit, or for activists to stop a mine. I realize that anti-mining activists have little or no interest in reforming regulatory schemes, which are at present effective in stopping mine development in the United States. I am taking aim at how regulations can best be structured to achieve sustainability. Again, reflecting on population growth and the real need to develop new mines, I am on the side of reform, or even revolution of the regulatory system, to accommodate both the legitimate need for mining, and appropriate control of environmental and social impacts. I am sincerely interested in seeing positive outcomes for both mining and the environment.

Regulatory Reform Ideas

Some of the alternatives to command and control regulation that I have taken an interest in use a bottom-up, or more decentralized approach, allowing for more individual participation, and more consideration of

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[39] *See* D. W. Brunton, *Mining Drainage Districts*, *in* PROCEEDINGS OF THE EIGHTH ANNUAL SESSION OF THE AMERICAN MINING CONGRESS 61 (1906).
[40] *The JORC Code*, JOINT ORE RESERVES COMM., http://www.jorc.org/about.asp (last visited Feb. 10, 2014).
[41] *See National Instrument 43-101*, ASS'N OF PROF'L GEOSCIENTISTS OF AM., http://www.apgo.net/ni43-101.htm (last visited Feb. 10, 2014).
[42] *Id.*
[43] INT'L CYANIDE MGMT. INST., *supra* note 19.
[44] INT'L ORG. FOR STANDARDIZATION, *supra* note 20.
[45] *LEED Certification*, U.S. GREEN BUILDING COUNCIL, www.usgbc.org/leed/certification (last visited Feb. 10, 2014).
[46] Linda Halstead-Acharya, *From Conflict to Cooperation: Stillwater Accord Endures,* BILLINGS GAZETTE (May 10, 2010), http://billingsgazette.com/news/state-and-regional/montana/article_1c761e60-687d-11df-920e-001cc4c002e0.html; *See* ROBERT CAHN, FOOTPRINTS ON THE PLANET: A SEARCH FOR AN ENVIRONMENTAL ETHIC (1978).
[47] *See* Iron Ore (Mount Newman) Agreement Act, 1964 (Austl.), *available at* http://www.austlii.edu.au/au/legis/wa/consol_act/ionaa1964329/sch6.html.
[48] *See* INT'L COUNCIL OF MINING & METALS, http://www.icmm.com (last visited Feb. 10, 2014).

local or regional differences in projects; more of an open source approach. Others use "management by exception," and "action forcing" mechanisms to rationalize the scope of regulatory action, and make it timely.

The Town and Country Planning Act that requires planning permission for nearly any proposal for a new land use in the United Kingdom and Wales, from a garden shed to a major industrial facility, has adopted such an approach.[49] Permission starts at the local level where impacts are assessed and mitigation is worked out. Larger and more controversial projects of regional or national concern can be dealt with more formally, including preparation of environmental impact statements. The Act has dealt with many controversial projects, such as nuclear power plants and mines in UK national parks. Garden sheds do not receive impact statements. The UK has neither an abundance of minerals nor money to spend on anything but the largest or most controversial mines.

I first became attracted to the Town and Country Planning Act model around 1978 at a time when I was active in state and national trade organizations concerned that pressure from environmental groups might result in the adoption of comprehensive federal land use controls by Congress. Looking for alternatives to command and control type legislation, I decided to take a close look at the British model, which I had some experience with during my time permitting mines in the UK. I was surprised to see that some U.S.-based NGO's had praised the Act, saying that it did a good job of handling the onshore impacts of offshore oil drilling. Those impacts occurred when the big North Sea oil rush brought rapid growth to the port towns that served the offshore drilling and production platforms.

I organized a group of U.S.-based land use specialists to tour England and Wales, examining the use of the Town and Country Planning Act as it was being applied to mine development, with emphasis on mines that were near or in national parks. We met with industry figures, planning agency officials, and representatives of environmental and land use NGO's. The results of that trip were presented in a paper that Whit Field and I published in the Wyoming Law Journal in 1978.[50]

I have not updated that study of the Town and Country Planning Act, but I know that the British government has amended the Act from time to time and that some very sophisticated planning projects have been undertaken under the Act. I suggest that the Center might commence a comparative law study of land use and environmental assessment laws of other countries that might offer better outcomes than current U.S. laws. What has happened with the Town and Country Planning Act since 1979? Has it really turned out to be a "streamlined planning process"? What kind of major projects have been approved, or stopped by application of the Act?

The Center might also take a look at the topics of "regulate by exception," and "action forcing mechanisms" that are a part of the surface mining regulations for public lands administered by the United States Forest Service.[51] These regulations work compatibly, at least early in the process, with the self-initiation features of the 1872 Mining Law. A prospector is free to go upon public lands administered by the Forest Service and undertake exploration activities without a permit or the filing of any notice, so long as the activities do not cause "significant disturbance of surface resources." If the activities look like they might cause significant disturbance, the prospector must give notice to the Forest Service so that it will have an opportunity to consider what the prospector proposes and to request a plan of operations. If the

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[49] Town and Country Planning Act, 1947, 10 & 11 Geo. 6, c. 51 (Eng.).
[50] H. Stanley Dempsey & T. Withers Field, *Mineral Development in the United Kingdom: A Streamlined Planning Process*, 14 LAND & WATER L. REV. 75 (1979).
[51] Charles F. Wilkinson & H. Michael Anderson, *Land and Resource Planning in the National Forests*, 64 OR. L. REV. 1 (1985); 36 C.F.R. §§ 228–29 (2011). *See* Dempsey, *Forest Service*, *supra* note 38; Dempsey, *Cautious Support*, *supra* note 38.

Forest Service is not concerned about the activity, it may ignore the notice, and the prospector is free to proceed. If the Forest Service does want to know more about the proposed activity, it may ask for more information, more time to review the activity, or request preparation of a plan of operations. This arrangement has some similarities to the "calling in" feature of the UK Town and Country Planning Act. The early part of the process includes some reasonable time limits on government response, and the entire scheme relies on the initiative of the prospector and miner who prepares the plan of operations that will ultimately prescribe the environmental controls and the measures proposed for mitigating environmental impacts of surface disturbance of lands used for mining and the review that is usually required by the NEPA.

The Forest Service regulations allow many types of exploration activities to go forward without regulation and record keeping. Forest Service personnel can work on what is important, leaving the rest unregulated. They do not have to study how to regulate things that will never happen. These regulations also include action-forcing mechanisms that discourage delay by the agency. If the time for action by the agency on a notice of intent (fifteen days) expires without any response from the agency, the prospector may proceed with the activity described in the notice. The Forest Service approach has the advantage of starting out with a proposal from the prospector. Presumably the proponent is in the best position to do the environmental and other assessments and to design mitigation strategies, relying on its own technical personnel, or consultants that it brings in. The proponent is likely to have a better knowledge of what is required than the agency, and has to live with the conditions that are ultimately imposed on the operation. If this assumption proves untrue, the agency has authority to take exception and bring in its own experts as a part of its review, including that required by NEPA. The best outcomes are likely to come out of a process where a competent operator proposes sound measures for "minimizing adverse environmental impacts on National Forest System surface resources,"[52] where the agency knows those resources well, and is capable of confirming in a timely fashion that the plan will work.

Special Regulatory Approaches

The development of special arrangements such as collaborative working groups, and voluntary codes of conduct, like those listed above, would make good topics for examination by the Center. In some cases, miners get together with other miners (or with neighbors and special interest groups) to work out ways to regulate mining activity outside of the conventional model of statutes and command and control regulations administered by the state. Examples of miners working together include situations where mining states have passed statutes allowing miners to construct tunnels for drainage of a group of mines and transportation and for the transmission of electricity over lines run in the tunnel. The tunnel is driven and operated by a special purpose tunnel corporation that is then obliged to allow all the mines that are drained by or accessible from the tunnel to be charged a fee for services. In Colorado, the tunnel company has the right of eminent domain and is regulated by the state as a public utility. This privatizes the drainage and transportation requirements of a mining district. Congress enacted a similar scheme through a special act that created the Sutro Tunnel, which was organized to drain the Comstock Lode in Nevada.[53]

Most mining companies are listed on public stock exchanges. Issuers of securities must comply with the listing requirements of the exchange they are listed on, as well as disclosure requirements mandated by governmental securities regulators. A key issue of importance to both sets of regulations is the issue of proper disclosure of information about the progress of exploration results and about production of an operating mine.

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[52] 36 C.F.R § 228.1 (2013).

[53] Joseph V. Tingley & Kris Ann Pizarro, *Adolph Sutro and the Sutro Tunnel*, *in* TRAVELING AMERICA'S LONELIEST ROAD 33 (2010).

The current system for disclosure of technical information about exploration or a mine in financial filings by public companies is a mixed private and public scheme. State and federal law requires that reports meeting certain technical requirements be filed with financial disclosure documents submitted by issuers of securities. The push for better disclosure rules came first from the best-recognized mining professional society in Australia, AusIMM, directly to the Australian stock exchange. The resulting JORC Code sets minimum standards for public reporting of minerals exploration results, mineral resources and ore reserves disclosure, and a mechanism for assuring compliance that requires certification of mineral reports made by individuals determined competent by a professional organization with an enforceable ethics code.[54] These professionals—designated as "Qualified Persons"—take responsibility for the report.[55]

The JORC Code has been a model for other nations and their mining professional organizations. The Ontario Securities Commission adopted a similar regulatory arrangement, which has become a very welcome and standard practice in Canada. Their version of a certified disclosure document is called a Section 43-101 report.[56]

It is not surprising that this regulation involves cooperation of issuers, stock exchanges, and mining professional groups, since this is an area where involvement by the private sector has been accepted by governments for more than a century. There is a long-standing tradition of voluntary regulation of stock exchanges.

Miners have also chosen to promote self-regulation in a number of other cases where governments are not well suited to regulate. Pressure for regulation of the use of cyanide in vat and heap leaching of gold ores brought the gold mining industry together to develop a protocol for safely handling transportation and use of the chemical cyanide. The "International Cyanide Management Code For The Manufacture, Transport and Use of Cyanide in the Production of Gold" is just one of several sustainability issues tackled by the mining industry.[57] ISO 4001[58] and LEED certification[59] are other examples.

Another important alternative to regulating mining with laws of general applicability is the "mining agreement" or "franchise agreement." A product of foreign investment to develop large iron ore, bauxite, and coal mines in Australia during the 1960s, these agreements are negotiated between the project developer and the State and ratified by the legislature to regulate the establishment and operation of large projects requiring substantial infrastructure development. They seem contractual, but are in fact regulatory in nature.[60]

Professor Anne Fitzgerald in her seminal treatise, *Mining Agreements,* gives one reason for the wide introduction and widespread use of legislatively ratified mining agreements in Australia, was that:

> [T]he negotiated model offered greater flexibility than was possible under the general mining laws. Where the legislation is outdated or inadequate to deal with large scale projects, as was the case when mining agreements began to be widely used in Australia,

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[54] *The JORC Code*, AUSTRALASIAN INST. OF MINING & METALLURGY, http://www.ausimm.com.au/content/default.aspx?ID=118 (last visited Feb. 10, 2014).
[55] *Id.*
[56] ASS'N OF PROF'L GEOSCIENTISTS OF AM., *supra* note 41.
[57] INT'L CYANIDE MGMT. INST., *supra* note 19.
[58] INT'L ORG. FOR STANDARDIZATION, *supra* note 20.
[59] U.S. GREEN BUILDING COUNCIL, *supra* note 45.
[60] *See* ANNE FITZGERALD, MINING AGREEMENTS: NEGOTIATED FRAMEWORKS IN THE AUSTRALIAN MINERALS SECTOR (2001), *available at* http://www.eprints.qut.edu.au/34063/2/Mining_Agreements_Anne_Fitzgerald.pdf; *see also* Iron Ore (Mount Newman) Agreement Act, *supra* note 47.

> resorting to negotiated agreements tailored to suit the circumstances of the particular project avoids the need for immediate legislative reform. . . .
>
> Mining agreements have typically been used for projects requiring substantial investment in infrastructure. Since the States were unable to finance the necessary infrastructure because of restrictions on their borrowing capacity imposed by the Loan Council, the contractual model offered a means of securing private investment in infrastructure. . . .[61]

Professor Fitzgerald goes on to say:

> There is little doubt that mining agreements have proven to be a flexible and convenient mechanism which enabled the States to implement their policies on natural resource exploitation and regional development. They facilitated the establishment of numerous projects and accelerated Australia's emergence as a major producer and exporter of mineral commodities. However, if the agreements are to continue to feature as a central element of mining regulatory regimes there are a number of issues which need to be addressed. . .[there is a] need for the relationship between the negotiated agreements and the general legislation to be more clearly defined as well as for greater transparency in the actual process of negotiation. The extension to Aboriginal communities of the rights to negotiate with proponents of mining developments prior to the granting of mining titles by the State means that further work is needed to accommodate Aboriginal mining agreements with franchise agreements. . . .
>
> Mining agreements have succeeded in imposing higher environmental obligations on the developers of large projects but enforcement of these provisions has been problematic. There is also a real potential for conflict between the ad hoc use of franchise agreements . . . and achievement of Australia's international obligations relating to progressive reductions in greenhouse gas emissions.[62]

I propose that the Australian model of franchise agreements be a candidate for another comparative law study by the Center. In some ways, the franchise agreement process in Australia bears some resemblance to the system used in the U.S. to permit large projects like the Keystone Pipeline, the Pebble project in Alaska, or the Rosemont and Resolution copper mines in Arizona. Does our system, which usually uses surface management regulations of the land management agencies (Bureau of Land Management and Forest Service, e.g.), put all issues on the table? Are all of the right stakeholders even at the table? How long does the Australian approach take, and how much does it cost? Is the Australian system more comprehensive than our system? I think these questions need answers.

Mining District Laws as "open source lawmaking"

How is open source organization for problem solving and development of legal controls applicable to natural resource policy? The following illustrates one surprising development.

Scholars interested in activities with open source characteristics have been drawn to the topic of the popular mining district lawmaking during the California gold rush of 1849 and the rushes that followed in the mountain west during the rest of the nineteenth century.

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[61] FITZGERALD, *supra* note 60, at 3.
[62] *Id.* at 3.

Miners flooded into areas of California where there was no law, so they made their own. Miner's rules worked well. Mining claim sizes and conditions for maintaining title were freely modified for local conditions, and the miner's governance and judicial systems generally conformed to contemporary notions of fairness and justice. Californians built a major gold industry using these rules. Likewise, rules adopted at miners meeting in the wilds of Nevada permitted development of the prolific silver mines on the Comstock Lode. When Congress finally got around to enacting a federal mining law in 1866, mining district laws were recognized and incorporated into the new law, and they were ultimately carried forward into the 1872 Mining Law.[63]

The 1872 Mining Law has its critics, mainly because of its self-initiated, preemptive right to claim mining lands that may put the miner into conflict with other users of public lands. The law has also attracted foes because in some cases mining has had unfortunate and largely unintended harmful consequences to the environment. It has been a very effective mineral tenure statute. Viewed as a law that encourages the discovery and extraction of minerals of importance to the nation, it must be said that it works. The United States has built major industries mining iron ore, molybdenum, copper, tungsten, gold, uranium, and a host of industrial minerals that are essential to maintenance of our nation's industrial base. Individuals and corporations responding to the reward for discovery inherent in the law have made such discoveries.

I return now to the discussion on the interest of academics in mining district governments and the rules they adopted The California gold rush was a seminal event in American history. The wonderful stories of discovery and great wealth, together with the pathos of the lonely crossing of the continent by wagon train, or of the horror and irony of the successful gold miners who sank to the bottom of the sea with their gold strapped onto their bodies, when the steamer U.S.S. Central America went down in a storm on its way from Panama to New York on September 9, 1857 brought the full attention of Americans to the gold rush.[64] The abundance of primary source material in existence today makes it seem as if nearly every scrap of paper of the gold rush years was preserved. Libraries hold vast collections of letters and diaries of gold rush participants, and every aspect of the rush has merited scholarly articles and books. Archivists in county courthouses and state archives have done much to preserve the documents that are important to an understanding of the districts. During the early years of the twentieth century, documents including originals or copies of mining district laws and a number of elegant private press books of mining camp laws were made available. Given the wealth of material available for study, it is not hard to see why the mining districts would attract the attention of those interested in popular law making. Many scholars

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[63] The mining district lawmaking story has long been of interest to students of mining and legal history. Mining law enthusiasts have traded scholarly blows back and forth across the Atlantic Ocean, trying to prove or disprove the theory that mining district laws were enacted by miners who had experience with mining rules in Europe or New Spain, and that the apex law that is still with us in the 1872 Mining law, came down to us from Germany, or Derbyshire, or New Spain. The battle over "diffusionism" was carried to new heights in 1988, when members of the Society of Mining Law Antiquarians and the Peak District Mines Historical Society joined in a celebration of the seven hundredth year anniversary of the Bar Moote (Miner's) Court at Bakewell, Derbyshire, United Kingdom, and held a conference on the origins of mining laws, including some heated discussion of "diffusionism". The conference ended with a banquet whereat the Duke of Devonshire joined the group, and was good sport about his families loss to the miners in 1366, when a royal commission ruled that free miners had rights to prospect and mine on lands owned by the Duke's forbearers, limited only by a duty to pay the landowner a royalty, and to avoid digging up church yards, burial grounds, public roads, and the Lady's rose garden. *See Chatsworth Celebrates publication of Ecton Mines History Book*, PEAK DIST. NAT'L PARK AUTH., http://www.peakdistrict.gov.uk/learning-about/news/current-news/chatsworth-celebrates-publication-of-ecton-mines-history-book2 (last visited Feb. 10, 2014); SOC'Y OF MINING L. ANTIQUARIANS, http://www.mininglawhistory.org (last visited Feb. 10, 2014) (on the subjects of diffusionism and other subjects of equal importance).

[64] *See* GARY KINDER, SHIP OF GOLD IN THE DEEP BLUE SEA (1998) (detailing the sinking of the SS Central America).

doing work in this area have successfully used primary source documents to produce credible findings, which are generally favorable to mining districts and mining district legal ideas.

A particularly important feature of mining district law is that Congress recognized the mining camp creations and even preserved titles acquired by compliance with the mining district laws. The survival of the mining district ideas of self initiation of claims, discovery as the source of title, tenure conditional upon occupying and working the claim, and the "use it or lose it" effect of abandonment or relocation where work had not been done, make the mining camp institution a great laboratory for studying popular, open source lawmaking. Mining district laws have been preserved, and some of their features can still be observed today.

I have been interested in mining district laws for many years,[65] first encountering them during title work on mining claims in Boulder County, Colorado. Boulder County mining districts like Gold Hill, organized in 1859 and 1860, were some of the earliest governments in Colorado. The laws of these districts owe much to precedents set in California.

In 2009, I was asked to take part in some of Colorado Sesquicentennial events, particularly those celebrating the first gold discoveries in the State. The Colorado Bar Association organized one such event. I was asked to give a talk on the mining district governments that were an important element of Colorado's adherence to the rule of law in its early years. As I worked on my paper for the Bar, I started to put together a bibliography of books and papers that dealt with mining district laws.

As I worked, I came across a paper by Dean James Grafton Rogers of Colorado Law (the "Law School" in those days) delivered in 1935. It was a bibliography of mining district laws.[66] I soon found that the Dean had done a near perfect job of finding and writing about every possible source of information on the subject. Thus, the only sensible thing for me to do was to reprise and update the Dean's paper. I have worked on the project for several years now, sharing the results as they become available by publishing them in Dips, Angles & Spurs, the newsletter of the Society of Mining Law Antiquarians.[67]

Through this work, I have become aware of a great deal of study and analysis of mining district law in recent years. Much of this work seems to support the notion that mining districts can serve as a laboratory for studying open source lawmaking. Many of these authors performed exhaustive work with original source material, giving us a better understanding of mining districts and their laws.

I will save some of the highlights I have extracted from these newer papers for Dips, Angles & Spurs, but I direct the reader's attention to them, as they are very important to both the history of the mining districts and to the ongoing discussion of open source lawmaking. A listing of these papers can be found on the Antiquarian website.[68]

Two things struck me in particular as I read these more recent papers. First, the authors describe how they had at first come to the conclusion that one of the negative features of mining district laws was the prevalence of "claim jumping," but had later found that what is loosely referred to as "claim jumping" is

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[65] Stanley Dempsey, *Mining District Rules: Popular Law Making on the American Mining Frontier*, 10 BULL. PEAK DIST. MINES HIST. SOC'Y 242 (1988).

[66] JAMES G. ROGERS & ROBERT L. STEARNS, THE MINING DISTRICT GOVERNMENTS OF THE WEST: THEIR INTEREST AND LITERATURE (1935). An address delivered at the Thirtieth Annual Meeting of the American Association of Law Libraries in a joint session with the National Association of State Libraries at Denver, Colorado, June 28, 1935. Reprinted from the Index to Legal periodicals and the Law Library Journal, Volume 28, Number 3, July, 1935.

[67] SOC'Y OF MINING L. ANTIQUARIANS, *supra* note 63.

[68] *Newsletters*, SOC'Y OF MINING L. ANTIQUARIANS, http://www.mininglawhistory.org/newsletters.htm (last visited Feb. 12, 2014).

not necessarily a bad thing.[69] The location system developed by the mining districts and carried on into federal law provides that a locator must meet certain standards of occupancy and work on a claim. The law was "use it or lose it," and the law allowed others to take over a claim if the original owner failed to meet the requirements of the law. While there was some unlawful jumping of claims, the legal relocation of mineral ground by someone willing to do the work was a good thing. It allowed full development of the resources and was a largely self-executing way to deal with the default. I suggest, "use it or lose it" concept as a topic we might usefully discuss with our colleagues at the Silicon Flatirons Center as a way to reform patent law.

The second thought that came out of my reading of these papers had to do with the concepts of self-initiated claims to public land, and maintenance of title by work and expenditures to advance the use of the site. I had recently read about Bureau of Land Management ("BLM") efforts to make sites available for construction of solar power facilities. BLM chooses sites in an *a priori* fashion and then performs a programmatic environmental impact statement in hopes of speeding up development of solar energy plants.[70] As radical as it may seem, a location system like that used in mining law might be an alternative approach to siting solar and wind facilities. This would let everyone participate in developing sites, not just the current firms, which could encourage innovation. Also, who knows better what they want in a site than someone who will back his or her expectations with an investment of time and money. Likewise, why prequalify a site if no one wants it? If a locator could stake a claim to a solar or wind site, she would presumably pay some kind of fee like the miner does. The claimant would have to do a certain amount of work developing a claim, and should be subject to relocation, or jumped, if she fails to do the work or pay the fees. Use of the site might be free of rent or royalty as a reward for completing a fully operational plant. Of course, the locator would have to meet the same environmental requirements as a miner, including NEPA review.

Let me caution that this proposal for staking of renewable sites is being made without any study on my part of the BLM's Solar Energy Program, beyond a quick look at its web site.[71] I do not want in any way to be critical of a program I know so little about. There may be good and sufficient reasons why a location system would be unworkable or inappropriate. I do want to encourage the Center to be willing to look at all kinds of approaches to natural resource development, even ones that might seem on their face to be unpopular or politically incorrect. The mining law is unpopular with many people, but not with miners. Self-initiation and other self-executing features like "use it or lose it," are all mechanisms that work when you want to find and develop a mine. Would these mechanisms advance other natural resource development, like the renewable plants that are now favored on public land? How could you favor them more than by allowing a free people a chance to invest their own efforts and money to make it work?

Permit me one last example of scholars testing the open source principles of the mining district laws, and in the 1872 Mining Law, against a modern activity. The second place entry in the California Supreme Court Historical Society 2011 Student Writing Competition, is a paper that "explores the legacy of California Gold Rush mining codes and its relevance to Los Angeles 'taco trucks.'"[72] The author asserts that "there are clearly stark difference between Gold Rush mining claims and today's taco truck claims. However, this paper will compare the two and from that premised study the issues that arise when private commercial activity flourishes on publicly held land."

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[69] Karen Clay & Gavin Wright, *Order Without Law? Property Rights During the California Gold Rush,* 42 EXPLORATIONS ECON. HIST. 155 (2005).
[70] *Solar Energy Program*, BLM, http://blmsolar.anl.gov/program/ (last visited Feb. 10, 2014).
[71] *Id.*
[72] Jaime Massar, The Taco Truck Rush: regulations in Boom Times, California Supreme Court Historical Society, Student Writing Competition (2011).

He concludes that:

> Taco trucks and the forty-niners sought to capitalize on a lucrative craze. Both groups of entrepreneurs soon developed informal self-governance and ways to limit access to claims in order to avoid a tragedy of the commons. Miners and mobile food vendors based their claim to a mining or vending area on an informal claim system whereby discovery principles governed. Just as the miners sought to control access to the diggings, so too have the mobile food vendors sought to control access to parking spots. . . .
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> However, the comparison breaks down when you compare the realities of the historical context in which these movements developed and the ensuing government response. Both the state and federal government allowed the miners to regulate themselves. They let the free market and self-government rule the day. By stark contrast, Los Angeles City Council relentlessly attempts to regulate taco trucks out of existence. City council members continue to propose rules and regulations aimed at taco trucks. . . .
>
> The professed health concerns over the food trucks belie the true motivation, to promote legislatively the brick and mortar restaurants over mobile food units.[73]

In closing, I must express real optimism about regulation of natural resource use and protection, and efforts to achieve sustainability in the mineral economy. I am fascinated with the notion of open source lawmaking, and encourage the Center to think about topics that will help us determine whether that kind of law making offers better natural resource regulation. I have much confidence in the good judgment of individuals who live in parts of the world that have been influenced by the constitutional heritage of the Magna Carta and the US constitution. We will see if the return to individual freedom and participation promised by open source lawmaking can be practically achieved here and in parts of the world with different legal heritages.

[73] Id.