



AVIATION REGULATION AS A MODEL FOR NANOTECH REGULATION

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Dr. Martine Rothblatt discusses the geoethical benefits of private and public aviation regulation toward creating a similarly based safe harbor for nanotechnology regulation.

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Since the topic of this workshop is Geoethical¹ Nanotech² regulation, I decided to look at similar systems. After looking at several it seemed the well-developed system for aviation regulation lent itself most logically to nanotechnology. There are many similarities between aviation and nanotech. Both are for private and public benefits as well as present and public risks. One of the other important similarities is that the risks of each kind of technology are difficult, if not impossible, to absolutely confine to a small geographic space. Because the risks cannot be geographically confined they present Geoethical issues. These Geoethical issues were resolved for aviation, so I'd like to see how those solutions would work for nanotech.

Geoethical aviation regulation is based upon several principles, the first of which is a harmonized set of global and local or national regimes. The global regime is called the

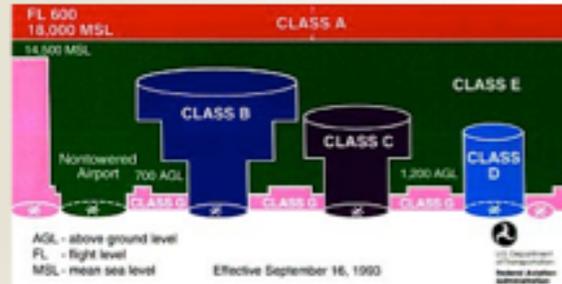
¹ Geoethics - an interdisciplinary field between Geosciences and Ethics that involves Earth and Planetary Sciences as well as applied ethics. International Association for Geoethics (IAGETH). (1992). Retrieved from <http://www.icog.es/iageth/index.php/20-2/>.

² Nanotechnology – "...consists of the processing of separation, consolidation, and deformation of materials by one atom or one molecule." Taniguchi, N. (1974). On the Basic Concept of 'Nano-Technology'. The International Conference Production Engineering Tokyo, Part II, Japan Society of Precision Engineering.

International Civil Aviation Organization³ and every country in the world is a part. Even so called outlaw countries like North Korea are represented in and comply with the ICAO. In the U. S. we have the Federal Aviation Administration⁴ with its federal aviation regulations. In the U.K. there is the Civil Aviation Authority (CAA)⁵ and so on.

The Aviation Approach to Geoethical Regulation

- National Regimes (e.g. FAA) Harmonized with a Global Regime (ICAO)
- Divisions of Geography into Airspace Zones
- Zone-Specific Rules
- Division of Technology into Categories
- Category-Specific Rules
- Authorization of Airmen



| Airspace Classes | Communications | Entry Requirements | Separation | Special VFR in Surface Area |
|------------------|----------------------|---------------------------------------|-------------------|-----------------------------|
| A | Required | ATC clearance | All | N/A |
| B | Required | ATC clearance | All | Yes |
| C | Required | Two-way communications prior to entry | VFR/IFR | Yes |
| D | Required | Two-way communication prior to entry | Runway operations | Yes |
| E | Not required for VFR | None for VFR | None for VFR | Yes |

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The second principle of Geoethical aviation regulation is to divide the airspace into many sectors based upon risk profiles of public harm. When you look up at the sky, it seems all blue and boundry-less, when in fact every part of the sky in every country in the world has been carved up into distinct Geoethical regulation zones. For example, over major cities and airports there is airspace called B or Bravo. Into this airspace nothing may fly that is not specifically invited into such space by air traffic control authorities. On the other hand, very low to the ground or very high and in remote areas there is airspace called G or Golf airspace into which there is no air traffic control at all.

³ International Civil Aviation Organization is a specialized agency of the United Nations. <http://www.icao.int/Pages/default.aspx>.

⁴ Federal Aviation Administration. <http://www.faa.gov>.

⁵ The Civil Aviation Authority is the UK's specialist aviation regulator. <http://www.caa.co.uk>.

The third principle of Geoethical aviation regulation is to develop detailed sets of rules for each kind of airspace. I've given you a couple of examples for B and G airspace, but there are many more rules. The basic idea is that as the risk to a geographically distributed public increases, the scrutiny over entry into that airspace is ramped up.

The fourth principle of Geoethical aviation regulation is to divide technology that may enter any particular airspace into different categories such as helicopters, airships, airplanes, jets and so on. Each kind of technology is permitted into particular Geoethical airspaces subject to rules that get stricter as the risk to the public increases.

Finally, the aviation Geoethical regime certifies that people may fly certain kind of machines in certain airspaces. Nobody can create an aviation risk to others without some level of certification and the certification requirements become more severe as the Geoethical risk increases. The aviation regulatory regime is undoubtedly a success. Over two billion people board a plane each year and last year saw the fewest aviation deaths in decades. Let's see how this might be applied to nanotech.

Geoethical Nanotech Similar to Geoethical Aviation

- National Regimes Harmonized with an Int'l Civil Nano Org
- Divisions of Geography Into Nanospace Zones
- Zone-Specific Rules
- Division of Nanotech Into Categories
- Category-Specific Rules
- Authorization of Nanonauts



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We would start with a harmonized set of national regimes linked to an organization that we might call the International Civil Nanotechnology Organization (ICNO). Similar to Geoethical aviation, the geography of national and international spaces would be divided up based upon potential risk to the public. Rules would be adopted for each space, types of nanotechnology would be defined (such as medical or environmental or self-replicating nanotech), and category specific rules would be defined.

Lastly, any person working in nanotechnology would be certified to do so based upon completing a program that focused on safety and proficiency. Even with a Geoethical regime such as that for aviation or what I have proposed for nanotech, there is no assurance of absolute safety. Unforeseen things and dangers can occur. However, the purpose of Geoethics is not absolute safety because if that were the goal, then progress would come to a halt. Instead, what I have proposed here is an extrapolation of Max More's *Proactionary Principle*⁶ and also of the *Truths of Terasem*⁷. For truly existential risks such as grey goo⁸ there could be a geographical nanotech zone limited to outer space. That is the way the aviation community would deal with a nuclear powered spacecraft, for example.

Rights Are the Reciprocal of Responsibilities

- A Right Is Accorded by a Society – There Are None in the Jungle
- No Society Accords a Right to Fly, Although There Are Rights to Qualify to Fly
- A Right to Qualify As Nanonauts Will Also Be Subject to Reciprocal Responsibilities



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In conclusion, we must remember that a completely lawless regime for nanotechnology is self-defeating. There can be no technological progress without a societal base of technology. Society extracts obligations in exchange for rights. The right to fly is balanced with an obligation to respect aviation regulation. I believe that the right to play with nanotechnology that has any

⁶ Proactionary Principle – an ethical, decision-making principle formulated by transhumanist and philosopher, Max More, PhD. <http://www.extropy.org/proactionaryprinciple.htm>.

⁷ Truths of Terasem – the core beliefs of the Terasem Movement organizations. <http://terasemfaith.net/beliefs>.

⁸ Grey goo - emphasizes that replicators able to obliterate life might be less inspiring than a single species of crabgrass. They might be "superior" in an evolutionary sense, but this need not make them valuable. Drexler, E.K. (1986). Chapter 4. In *Engines of Creation*. New York: Anchor Books.

kind of potential for causing harm over geographical space should be balanced with a responsibility to comply with the obligations of being regulated as a nanotech practitioner.

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