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Towards a free matter economy (Part 6)

Legal Landmines

Terry Hancock

This article explores the legal problems that will be faced by free-design communities developing hardware for space.

I have learned that distributed problems require distributed solutions—that centralization of power, the first resort of politicians who feed on crisis, is actually worse than useless, because centralizers regard the more effective coping strategies as threats and act to thwart them.—Eric Raymond

A strong free design economy will have to deal with the realities of the legal systems in which it must operate [1]. Intellectual property law is currently changing, inconsistent between nations, and under substantial pressure from those with a vested interest in preserving outmoded business models against the inevitable changes that new communications technology has brought. Furthermore, putting the ability to design and create in the hands of ordinary people creates a threat to the power elite, who will then have a harder time controlling forbidden technology and the forbidden knowledge required to create it.

The result has been the mining of the noosphere—a net of legal obstacles intended to ensnare free thought and keep the old power structures intact. There is more at stake here than is usual in the field of free software—free-designed nuclear weapons or biological weapons could destroy civilization just as easily as their proprietary, government-controlled cousins. We can't shirk that responsibility. Nor, however,

can we allow it to halt human progress by turning our free society into an unnavigable maze of professional guilds and corporate fiefdoms.

Patents

The most prominent hazard for individual inventors today is the proliferation of patents.

How did we get into this ironic position? After all, the basis for patent law (at least in the United States), is supposed to be the encouragement of invention by allowing inventors a proprietary period to cash in on their inventions before they enter the public domain. Or, as Abraham Lincoln put it:

Next came the Patent laws. These began in England in 1624; and, in this country, with the adoption of our constitution. Before then, any man might instantly use what another had invented; so that the inventor had no special advantage from his own invention. The patent system changed this; secured to the inventor, for a limited time, the exclusive use of his invention; and thereby added the fuel of interest to the fire of genius, in the discovery and production of new and useful things [2].

The reality is further from the ideal, however. Filing for a patent is a difficult and expensive process that most inventors would be hard-pressed to do on their own; the volume

Abraham Lincoln was the only US president to hold a patent (Number 6469)



of patents which must be searched to prove the absence of prior art is enormous; and the cost of expert help in this process is too high for the average individual. The result is that very few individual inventors use the patent system at all.

Even for the ones who do file, the patent process is unlikely to be helpful. Having a patent on an idea does not commercialize it—you still have all the usual problems of an entrepreneurial startup. Furthermore, until a patent is granted, the inventor is likely to hold back on describing their invention, even to people who might be interested in helping them. In a world of free information interchange, it is often not the original spark of an idea that proves profitable, but the results of exchanging shared information in an open forum of interested parties. The possibility of proprietary gain retards this free exchange of information and thus creates an infertile intellectual landscape.

Intellectual landmines

The most serious thing about patents, though, is that they can harm you even if you don't use them, know nothing about them, and never see or make use of anyone else's ideas. Because, independent invention, though it might rightly be regarded as proof of "obviousness", is no defense against a patent infringement claim: even if your design is

completely original, you may have accidentally reinvented something to which someone else has exclusive claim.

What's more, such claims can be truly devastating to your project, because the patent-holder can not only sue you for "damages", but may also get a court order to stop you from using your own ideas (and any ideas that depend on them).

This makes patents even more of a landmine than accidental copyright infringement: at least with copyright, you cannot really infringe unless you have copied someone's work—and you can be expected to know when you've done that. But patents can and do blindside designers.

This has recently become a serious issue for software patents, but in truth, it is a problem with all patents: obvious designs, natural phenomena, and mathematical truths are now being granted as patents, due to a severely-flawed patents system in the United States, and through a series of treaty organizations [3], the same pathology is spreading to other nations as well.

Too much of a good thing?

These problems with granting proprietary rights to information are not new, by any means. Thomas Jefferson argued

Excerpt from "Bound by Law", a comic expounding on the problems of copyright and the public domain. Patents are even more of a minefield than copyrights (Duke Center for the Study of the Public Domain, CC-BY-NC-SA/Fair Use)



famously that there are no natural rights to intellectual property:

He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening mine. [...] That ideas should freely spread from one to another over the globe, for the moral and mutual instruction of man, and improvement of his condition, seems to have been peculiarly and benevolently designed by nature. Inventions then cannot, in nature, be a subject of property [4].

He went on to argue that such rights, being artificial, may be freely managed by nations (or not) according to what is perceived as the most effective way to spur innovation. This is pretty important, because Jefferson also wrote this famous bit of text:

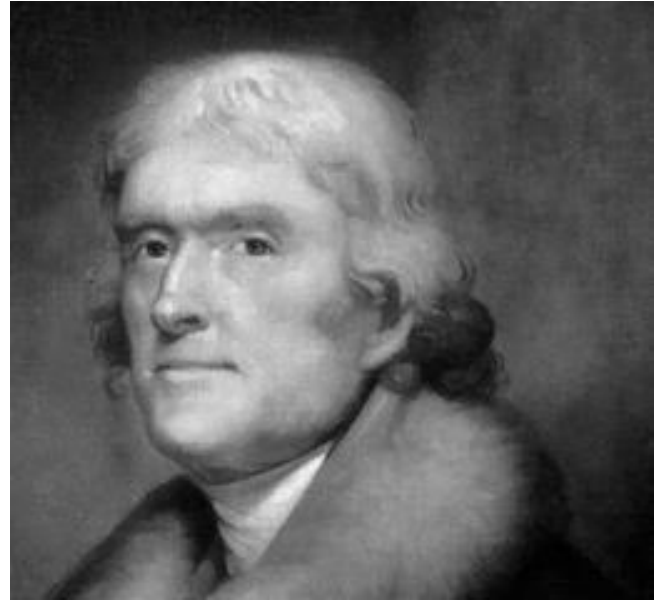
The Congress shall have power [...] to promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries [5]

This is, of course, the constitutional basis for all copyrights and patents under United States law.

Considering this sensible starting point, it is ironic that abuses of patents and copyright laws in the United States have presented the greatest danger to innovation worldwide. In other parts of the world, as in Europe, the theory has been worse, but the practice better. European law regards intellectual property as a natural human right, which makes its infringement a criminal offense. Lax enforcement has kept this from becoming a serious problem so far, and Europe has avoided the spectre of software patents, but it remains to be seen how long this amicable arrangement will last.

Originally, it was intended that patents should be rare. Mechanical devices and processes of the type that could be found in 1800 were always “open source” in the sense that anyone could immediately “reverse engineer” them by simple visual inspection [6]. There was also very little natural advantage in having the processing equipment or tools and dies for production, since the assembly line was still many years in the future, and even printing technology was fairly

Thomas Jefferson opposed the idea of intellectual property as a natural right



primitive. This made the need for patents appear evident and the harm small.

Since the 1980s, however, there has been an explosion in patent applications, to more than 300,000 per year [7]. This may mean there is more innovation going on, it's also because the bar for receiving a patent has been made extraordinarily low, and the breadth of what can be patented, ridiculously wide. Due to this overload of applications, the US Patents and Trademarks Office (USPTO) has seen a great reduction in the quality of its patent searches. And, lacking sufficient personnel trained in the various “arts” that it issues patents for, it cannot effectively gauge the merit of patent applications. This has resulted in even more bad patents being granted, encouraging further abuse, and so on.

Who's getting all these patents? Are there millions of lone inventors in America who need our protection? No. The bulk of patents are filed by corporations, and the current patents free-for-all is primarily due to enormous amounts of filings by corporations, which use their “patent portfolios” both as advertising to stock-holders (who continue to regard the acquisition of patents as synonymous with innovation), and as weapons to use against each other (ironically, to defend themselves from the same mines that endanger individual inventors).

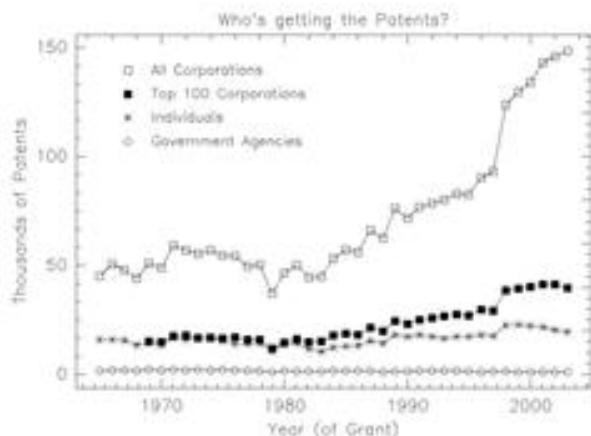
Patent applications have grown enormously since about 1980



Minesweeping?

Recently, there have been four initiatives (Patent Commons [8], Peer to Patents [9], Open Source as Prior Art [10], and the Patent Quality Index [11]), which have grown out of the software industry, the free software community, and the USPTO's concern with its workload. These initiatives have primarily targeted software patents, though the same techniques might help patents in general, by reducing the number of patents granted, increasing the quality of those patents, increasing community knowledge of patent qual-

The overwhelming majority of the post-1980 boom in patent applications is coming from corporations, not individual inventors



ity, and increasing the recognition of community-developed prior art. These initiatives offer some hope, but they are an incomplete solution: laws to raise the standards for patents and reduce the scope of information that can be patented are desperately needed. These initiatives are best regarded as stop-gap measures—indications of a failure in the system itself.

We might even need to start asking ourselves if it wouldn't be better to simply ban patents entirely

Considering the realities of the information age we live in, we might even need to start asking ourselves if it wouldn't be better to simply ban patents entirely. While it's almost certainly true that patents do some good, it's also pretty obvious that they do much damage, and a system without any patents might be a safer place for innovation than what we have now.

Trade secrets

Even if there were no patents, there would still be trade secrets. The basis for a trade secret is in contract law: it is common practice to insist upon the signing of a "Non-disclosure Agreement" (NDA) before being shown certain kinds of information that an individual considers critical to a new business plan. This allows potential business partners and investors to be aware of the information needed to evaluate the company without sacrificing the advantage provided by secrecy.

NDAs have also become fairly common in the electronics industry, to protect product lines that are already in production. This is intended to maintain the company's competitive edge in the same way that a patent would, but without the legal overhead. Courts recognize these obligations to secrecy, and it is through contract law that trade secrets violations can be enforced.

A trade secret is relatively innocuous, because it specifically requires you to have copied the idea—independent invention is not affected, and you may, under most circumstances, reverse-engineer a product in order to extract design information about it. The primary threat to free innovation is the unfortunate practice of using trade secrets

against the end-user by not publishing necessary interfaces to hardware—something that has recently become a serious problem for free software multimedia users.

Copyright

Copyright is the form of intellectual property that most programmers and software users are familiar with. It applies to most software and many integrated circuit and printed-circuit board designs. Copyright doesn't protect "ideas", but rather specific "expressions". Therefore, it is much narrower in that it affects only nearly exact copies of the design. An independent design which expresses the same ideas in a different way is different under copyright, and so does not infringe.

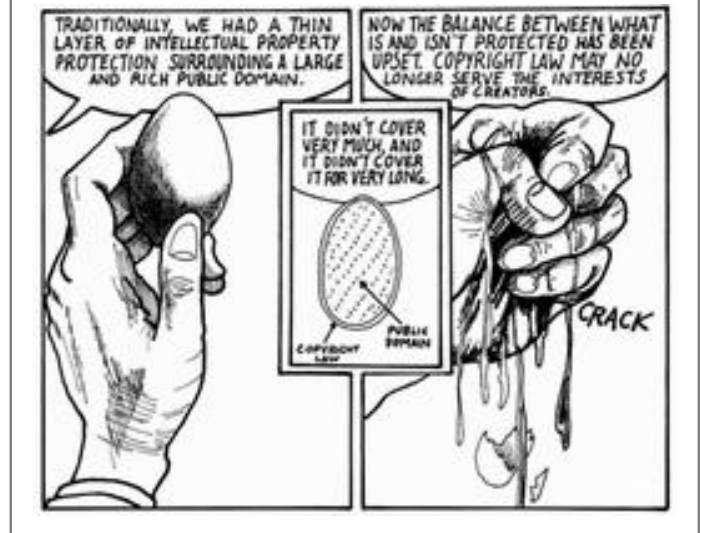
The problem copyright creates is primarily that, by imposing costs on reuse of already-existing designs, it results in reduplicated effort. In the present legal regime, the boundaries of copyright have been extended too far: the rules of "fair use" are being unfairly restricted, and the durations of copyright (initially intended to be granted only for "limited times") are effectively unlimited in that they may persist longer than so-called "permanent" rights (such as real property ownership) [12]. The result is that existing rights-holding corporations (which profit from intellectual property, but do not create it) are very happy, but the public domain material that serves inventors, artists, and the general public in the process of new innovation is being starved [13].

Fortunately, the free-licensing of software [14], artistic works [15], scientific publications [16], and hardware designs [17] is proving to be an effective solution. The invention of "copyleft" by Richard Stallman, has made it possible to establish communities with higher degrees of information exchange and therefore higher levels of innovation. This reduces the threat of the current legal problems with abuse of the copyright system, although recent developments such as "Digital Rights Management", "Trusted Computing", and the "Digital Millenium Copyright Act" show that there are still important problems that require legislative solutions.

Telling cannons from canoes

Space technology is real power. In fact, much of the real power used by governments to exercise their "monopoly on

Copyright protection has gotten out of hand, with extended terms and a diminished interpretation of "fair use" (Duke Center for the Study of the Public Domain, CC-BY-NC-SA/Fair Use)



the use of licit force", as Libertarian political philosophy describes it, is embodied in space technology, like Inter-Continental Ballistic Missiles (ICBMs) or intelligence-gathering satellites which can read your car's license plate from low Earth orbit. Nuclear power, essential to many space development plans, is widely regarded as one of the most dangerous technologies in existence—nuclear material is contraband, and designs for nuclear plants (let alone explosive devices) are closely-guarded secrets.

In the interest of reducing public hazards and in maintaining the United States' military advantage against other countries, the US has the "International Traffic in Arms Regulations" (ITAR), which are supposed to prevent various "blackhats" from acquiring access to technology that could be damaging to its national security. This sounds sensible enough on the surface—but what exactly are "arms" and what are not? In the 1990s, US computer free software developers had to deal with onerous restrictions on what they could host on their web servers, simply because "strong cryptography" (as implemented in several internet web browsers) was on the ITAR "munitions list" [18]. This was the original reason for the Debian "Non-US" distribution.

Ironically, this did nothing to support US supremacy in cryptography—the algorithms could be printed in a book and shipped overseas (even with complete program listings)

without violating ITAR. The same book could, for that matter, contain instructions for building a nuclear weapon. In the end, the software was hosted on servers outside the United States, and much to their shame, US users had to download their cryptographic software from overseas servers!

Unfortunately, this did not break the ITAR laws. Instead, the US legislated a special exemption to the law for software which was downloadable for free. Meanwhile, the “munitions list” remains remarkably broad. Among other things, it includes satellites of almost any kind, as well as nuclear devices (both power-generating and explosive), rockets, and propellants. ITAR continues to promote the longstanding myth that space development is state-controlled territory, too powerful for ordinary citizens to participate in.

ITAR has been blamed by space industry professionals as a major obstacle to US companies remaining competitive internationally, noting that European companies have used their lack of such onerous regulations as a selling point to acquire communications satellite contracts [19]. ITAR is a loose cannon for individual space developers, because it doesn’t seem to be able to distinguish essential technologies for space development from weapons.

Controlled substances

Most rocket experimenters have already learned that explosives are usually controlled substances. In the United States, they are monitored by the US Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), a division of the Department of Justice [20]. Other nations have similar rules. In the UK, for example, explosives must be registered with the police [21]. Various licenses and permits will allow you to use limited quantities of these substances.

“Explosives” of course, includes most substances that would be used as solid rocket fuels. There is some obvious sense to these kinds of regulations, since the exact same material that you might want to use to send your amateur rocket up to the edge of space [21], might be used by more nefarious actors to blow up a neighbor’s apartment.

Sensible regulations are needed for such dangerous substances, of course, but it is also important that the licensing processes be simple enough for amateur developers to gain access to them, and that merely acquiring them does not become perceived as “evidence of terrorist activity” [23].

Nuclear power is an even more volatile subject. In the United States, this is managed by the Nuclear Regulatory Commission [24], and getting a license from them makes the ATF licensing for explosives seem easy. Nevertheless, licenses have been given to academic institutions—several universities operate nuclear reactors for research and teaching of nuclear engineering [25] and there is an experimental tokamak for researching high-temperature plasmas at the University of Texas [26].

No fly zones

Space is straight over your head. There is an internationally recognized “boundary” of space at 100 kilometers altitude. This number is based on the fact that at just about that altitude, a vehicle stops acting like an aircraft and starts acting like a spacecraft (aerodynamics breaks down).

The rules of “fair use” are being unfairly restricted, and the durations of copyright are effectively unlimited in that they may persist longer than so-called permanent rights

It used to be that real property rights were imagined to extend down to the center of the Earth and upwards to infinity. Fortunately, this absurdly geocentric view of the universe has begun to be redefined legally—most courts now recognize the idea that there is some ceiling to terrestrial property rights and to the legal authority of terrestrial nations. The 100km limit, also known as the “Kármán Line”, is beginning to acquire this legal significance [27]. It would be overstating the case to say that this is firmly established in law—space law is far too young a field for that. However, events such as the X-Prize [28] flight of SpaceShipOne [29], have established the idea that “space begins at 100km”.

However, that still leaves 100km of airspace between your launch pad and freedom; all of which are protected by some national organization in your country. In the United States, this is the Federal Aviation Administration (FAA). The FAA is the agency that must provide waivers for amateur rockets to be launched to high altitudes (you can launch “model rockets” in most parts of the United States without any special license, fortunately—these are the small rockets you

SpaceShipOne, imaged at the “Edge of Space”, above 100 km altitude (Scaled Composites)



can find in hobby stores in the US). It is also the FAA that regulates airports and the fledgling commercial spaceports that are currently active in the US [30].

Other limitations include treaty agreements requiring national sponsorship of any object launched into space (requiring such launches to be registered with some national government), and treaty agreements on the management of the (relatively limited) use of geostationary orbit (also called “geosynchronous” or “Clarke” orbit, in which objects orbit such that they appear stationary from the surface—this is the preferred orbit for most communications satellites) [31].

Explosively decompressing our values

Perhaps the most suffocating of all the regulations that stand in the way of space development are those which are intended to protect consumers from risk. Living with risk is an essential part of every frontier, and the ancestors who pioneered the place you are sitting now—whether they were wagon train colonists or islanders in outrigger canoes—took risks. Sometimes horrible risks: the death toll on settlers crossing the American West in covered wagons in the first half of the nineteenth century was appalling by today’s standards, as were the adventures of immigrants crossing the Atlantic in sailing ships only a century before.

Our blood seems to have thinned, however: the deaths of seven astronauts have twice halted the entire space transportation system of the country which likes to call itself “the home of the brave”. The *Challenger* accident shut down

all crewed transportation into space for Americans for over 18 months; the *Columbia* accident shut down all US-based space transport for over two years (Fortunately, Russian-based *Soyuz* launches have been available to keep the International Space Station crewed for this entire time).

It’s true that the Space Shuttle has design problems, and I don’t doubt that those problems contributed to the deaths of fourteen people. The problems need to be fixed. But I also know that every one of those fourteen people knew about that risk, and were still willing to board those Shuttles. As would I. The risk is not negligible, but exploring (and developing) the space frontier is an important task—one worthy of some risk of life.

But our society has become obsessed with “safety” to an unhealthy degree. Frivolous liability torts have made most smaller companies (and nearly all individuals) financially unable to support the development of any product which might be used in “life-critical” applications. Even software frequently bears notices disclaiming suitability for such uses. Ironically, this is true even for extraordinarily stable free-software packages that would probably be the safest available bet. But, although that’s *probably* true, there are serious legal consequences to *asserting* that it is true, and the present legal regime makes the sale of a product tantamount to that kind of assertion.

The basic legal principles behind liability laws do not appear to recognize two fundamental realities of life, especially on a frontier: risk is unavoidable, and it’s not anybody’s “fault”. Even if everyone is being as careful as is humanly possible, there will still be serious risks to any enterprise as fundamentally adventurous as exploring, developing, and settling in space. Some kind of adjustment in social attitudes is necessary if we are ever going to regain the pioneering courage of our ancestors.

Settlers, developers, and experimenters need to be able to legally assume risks for themselves—or they will be unable to find suppliers. This is a problem, because existing laws only recognize that kind of assumed risk for companies, but individual experimenters and inventors are usually classified as consumers. Ironically, it is more legal for an employer to order you to take risks than for you to choose to take them on your own volition!

This applies to obvious things like explosive or rocket-propelled devices, but also to less obviously dangerous technology, like spacesuits. An amateur spacesuit can kill you,

Amateur rocketry can be a pretty wild hobby. The Mini (which is unmanned!) is being powered down a ski slope by three rocket engines for a BBC 2 stunt. Amateur rockets can be quite large (upper left inset), and the launch of such a vehicle can be impressive (lower right inset). Obviously, this is only possible in a society that lets people get access to high-powered propellants. (Wirral Rocket Society, CC-BY-SA)



just like sticking your head in a plastic bag can—if the life-support system doesn’t work properly but the airtight seal does. Yet, how can an amateur developer be expected to bear the liability burden for this? It could be argued that you ought to be able to make this kind of safety decision for yourself—but although seller and buyer may both agree to this high level of assumed risk, present liability standards do not.

This kind of legal risk, and the high cost of insuring against it, is a large part of why there are few commercial life support suppliers to which hobbyists can turn for parts, and it’s part of the reason that such equipment, when it is available, is so expensive (It is likely that SCUBA gear is only available today because it largely predates the changes in liability standards).

Informed consent

Some solutions for liability problems have been developed. Amateur rocket societies, which are often engaged in intrinsically risky activities such as igniting large amounts of explosive fuel in order to launch their creations (which occasionally fail—becoming “lawn darts” or “land sharks”), sometimes get around public safety laws by not allowing “the public” to attend launches. Instead, only members of

the society who have signed a liability waiver are allowed to attend. This can be fairly painless since such societies often extend membership to attendees who are willing to join and sign the waiver.

I would argue that free-design, as “full disclosure” should make any risks as accessible to the user as to the manufacturer, and should therefore be an adequate defense against liability cases. It should be possible to make purchases on this “experimental” basis, signing off the right to sue for personal damages, in order to avoid incurring the prohibitive expenses of liability insurance. This has not yet been effectively implemented.

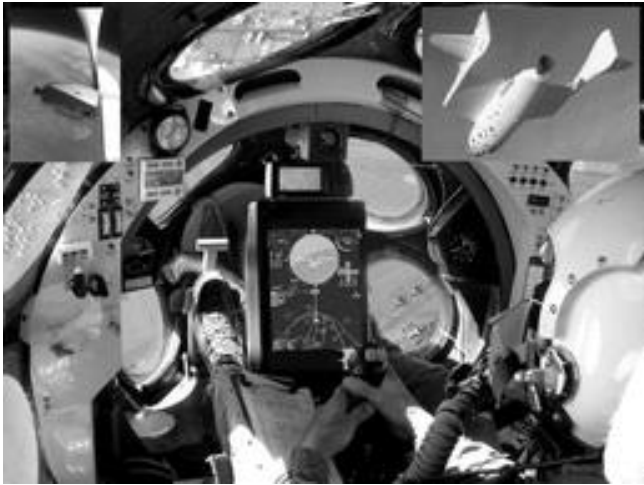
Making the world safe for innovation

We are already on an crowded planet. We’ve long since passed the point where we could just put down technology and go back to the way things were. Either we develop space and a sustainable economy that uses its resources; or we face a bleak future of dwindling resources and a global dark age until the attrition of war, poverty, pestilence, and famine reduce our population to a sustainable equilibrium (and we have another chance to choose space). We could easily lose fifty generations that way, as Europe did at the end of the Roman civilization. Facing these choices, as our overpopulated and underprovided civilization tracks down its present collision course with the limitations of a closed Earth, we have to ask ourselves, “Do we have the *luxury* to be less innovative in the name of preserving outdated business models?”.

Patents can and do blindside designers

Space technology is not the only area where community-based production of fundamental technologies may be important in the coming century, but it is one of the most exciting, and probably the one that raises the largest variety of legal issues. Yet we cannot afford to ignore it. Our civilization needs to develop space, and after thirty years of snail’s pace development by government agencies and corporate contractors, it’s fairly obvious that the “NASA owns space” attitude needs to be canned. Current developments in conventionally-financed entrepreneurial space start-up companies like Scaled Composites [32], Virgin Galactic [33],

SpaceShipOne's flights have been the flashiest of the achievements of independent space companies to date. (Scaled Composites, inset from Wirral Rocket Society)



and SpaceDev [34] are showing a lot of promise. But, there is a need for the broader involvement of a free design community to develop the everyday technologies of the frontier—and a legal climate that is more conducive to the fertile growth of ideas.

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