SATELLITES IN THE NEXT MILLENNIUM, AVOIDING THE LEGAL NIGHTMARES ON THE FIELD OF DREAMS

by
Stephen Tucker

Introduction

My now retired partner, Matt Corrigan, once wrote an article for the American Bar Association Journal entitled, *Outer Space Lawyers: Eagles or Turtles?* That was thirty years ago. Today, the question still has not been answered. There can be little question that legal dilemmas present a greater barrier to the exploitation of space than do any limitations posed by technology. The law is generally slow to respond to societal change. Unfortunately, the technology driven agenda does not leave much time for the consideration of sociology or jurisprudence. It is the intent of this article to provide a brief overview of the expected direction the relevant technology will be taking and the legal quandaries that will be inseparably connected therewith.

Background

Satellites have certain inherent characteristics which make their individual uses relatively easy to categorize, to wit:

a. Communications,
b. Manufacturing,
c. Remote Sensing,
d. Positioning,
e. Habitation, and
f. Energy Collection.

These uses raise an almost limitless number of legal issues, some of which have yet to become clear during the current century. But there can be little doubt that the major issues turn mostly on matters of privacy, questions of sovereignty, and matters of the environment.

Communications

Attention will first be directed towards the field of communications. Advances in technology are driving, and will continue to drive into the next century, communications towards increased mobility and expanded throughput. There is almost an "if you build it, they will come", attitude among the major suppliers of communications services and equipment. As the Wall Street Journal reported:

> "Consumers will be dazzled by the services that will be available . . ., from roam-anywhere global telephones and detailed photos from space to futuristic two-way video and data transmission that will speed everything from meetings to medical treatments."

With respect to trends towards expanded throughput, the Direct TV/USSB DBS system provides an interesting example. The system makes use of two Hughes HS-601 communications satellites and one HS-601 in-orbit spare, all three of which hovering over West Texas, to provide almost 200 channels of service. There are sixteen transponders on each satellite. According to press reports, the number, and growth rate, of subscribers to this system has wildly exceeded the expectations of the major principals. With almost 200 channels available, narrowcasting has become a reality. Now choices such as The Golf Channel, House and Garden TV, and the TV Food Network can thrive, thanks to digital compression.

But one only has to look at electronic bulletin boards on the major online services to realize that these DBS services are subject to being received in Mexico, Central America and around the Caribbean. And these signals are encrypted and only intended for reception in the United States. One must ask the question how can transborder reception be controlled? And what would be the potential response of a country with highly oppressed masses to widespread reception of information that doesn't exactly carry the message of the bourgeoisie?

With respect to trends towards the increased mobility of personal communications, one need only consider 2-way paging, which has, just recently, become a reality in the United States.

The service is provided by way of a Motorola Tango model pager. On a local level, the pagers operate in the region of the radio frequency spectrum near the cellular service. The system uses redundant transponders on geosynchronous satellites (the primary satellite reportedly being GE Americom Satcom C5) and it also employs redundant switching computers on the ground.

Alpha-numeric messages are sent to the pager after being entered into the system using PC software interfacing directly with Skytel or by making the connection with Skytel indirectly through the Internet's World Wide Web at www.skytel.com. Once a message is received at the pager, a number of simple responses are built in, to wit:

1. Yes, OK
2. No
3. Will call later
4. Call me
5. On my way
6. Running late
7. Need more info
8. Send # to call
9. Where are you
10. Will arrive 15m

11. Will arrive 30m
12. Traffic delay
13. Pick me up
14. Busy
15. Finished
16. Call home

And the sender of the page message also has the option of suggesting other potential responses from which the receiver of the page can select.

The potential uses of 2-way paging are limited only by the imagination. But some of the suggested uses should cause some concern.

One of those suggested uses in particular brings to mind a famous legal case which first year law students in the United States have been struggling with for years. The case, *Marvin Katko v. Edward and Bertha Briney* (Iowa Sup. Ct. 1971), is known by the shorthand expression "Spring Guns in Iowa". The primary issue presented in the case is whether an owner may protect personal property in an unoccupied boarded-up farm house against trespassers and thieves by a spring gun capable of infliction death or serious injury. In the case a burglar was seriously injured by a spring gun under just these circumstances. The law only allows the use of this level of force when someone is in great fear for their own bodily injury or for their life.

One suggested use of the pager that could cause concern involves car theft. The idea is that the 2-way pager could be used to kill the ignition on a car as soon as the car's owner realizes it has been stolen. The pager (in the car) could then transmit information from the global positioning receiver (also installed in the car) to provide its location in terms of latitude and longitude. The only problem with this is that killing the ignition could occur at a particularly precarious time, putting the car thief, and others, at great risk. One only need ask the question, what happens if the page disables the car at a time when it is sitting on a railroad track, or when passing another car on a two lane road, or any number of other precarious situations. Potential use of the 2-way pager as a means of implementing some sort of untended remote control is fraught with difficulty.

As another note concerning the legal issues created by the increasing mobility of personal communications, the importance of protecting privacy cannot be underestimated. With communications being carried by means of radio waves, there is no longer a need for eavesdroppers to do anything physically, such as connect alligator clips to copper, in order to listen in. Encryption technology, with all of its attendant shortcomings, will be key in the 21st century.

Finally, with the likelihood that there will be thousands of satellites utilized in constellations in all sorts of earth orbits in the next century [consider Bill Gates' Teledesic system proposal with a staggering 840 satellites alone], the risks of collisions in space will significantly

increase.

Manufacturing

One need only subscribe to the Wall Street Journal to realize that industry leaders and academia have, as of late, been predicting that an explosion of growth in industrial activity in space will take place in the next century. Some have even predicted as many as ten million jobs being created and $65 billion in annual revenues connected with industrial space in the early years of the 21st century. Of particular interest to this group, the ability to obtain adequate insurance for these ventures will surely influence whether those predictions become reality. And the development of a substantial body of law to regulate these activities must be an indispensable part of any successful plan.

There are two primary characteristics of space that account for its attractiveness as a potential site for factories. They are: high vacuum and low gravity.

High vacuum makes for minimized contaminants, thereby allowing for purer versions of drugs, alloys, and other products. Occluded material in the form of contaminants showing up in crystal structures, and in and amongst welcome molecules, can wreck havoc with product characteristics. As an example, microchips powering today's PCs are estimated to be operating at 1/10th the speed they could achieve had the material used in their chips been grown in space. That would mean that today's 200 MHZ Pentium chip could ideally be operating at 2000 MHZ. This is an enormous increase when one considers that the upcoming replacement for the Pentium series chip will likely not even double performance.

With respect to the microgravity environment of space and its attractiveness to manufacturers, the following is instructive:

> "In a microgravity environment many normally inhibiting effects are reduced. Metals, alloys, ceramics, and glass are all expected to yield new materials with new properties. When crystals are grown in a terrestrial laboratory, gravity can cause density changes that lead to convection currents. This effect is nearly absent in space. Consequently, alloys can be made much more homogeneous - the materials are not separating out because of density differences. We also expect that creation of entirely new alloys will become feasible. Moreover, structures are normally shaped; by strength requirements imposed by gravity; take away gravity, and new structures of greatly extended dimensions may be possible. Limits on size of structures may be set by inertial considerations rather than weight."[1]

[1] John L. McLucas, FRONTIERS OF SPACE, Space Commerce, pg. 191 (Harvard University Press 1991)

The current law regulating manufacturing in space can, at best, be viewed as fledgling in nature and, at worst, be considered a vast wasteland.

Insofar as regulation by international law goes, there are four treaties [named in shorthand here], to wit:

1. The Outer Space Treaty of 1967,

2. The Astronaut Rescue and Object Return Treaty of 1968,

3. The Convention on International Liability for Damage Caused by Space Objects of 1972, and

4. The Convention on Registration of Objects Launched Into Outer Space of 1975.

Viewed collectively, these treaties, although recognizing private enterprise, really have as their essential purpose defining relations between nation-states.

One commentator has noted that with respect to manufacturing in space, the following legal questions, among others, have yet to be answered[2]:

1. Does international law prevent or limit private enterprise manufacturing in space?

2. Do domestic laws restrain or limit space manufacturing?

3. What is the legal relationship between a nation and a private space manufacturer within its jurisdiction and what is "jurisdiction"?

4. Who has the rights to intellectual property associated with products produced, processes invented and data generated from space manufacturing?

5. Do patent laws apply to all space inventions?

6. Who is liable for damages resulting from errant space manufacturing, and what is that liability?

7. Is there an environmental law governing space waste?

[2] Robert F. Scoular, THE SPACE FACTORY AND THE LAW, pg. 5 (International Bar Association 21st Biennial Conference Proceedings (1986)

8. Are space products taxable?

9. Do import and export laws and regulations apply to the raw materials and end products of space manufacturing?

10. Are space manufacturing personnel subject to domestic employment laws?

11. Do antitrust laws apply to space manufacturing?

Remote Sensing

Remote sensing satellites generally collect electromagnetic information passively radiated by the surfaces of celestial bodies. The uses of this data (with respect to the earth as a target) are many and include natural resources management, environmental control, and military and strategic planning. Some specific earth-based uses include:

1. agriculture (e.g. crop management and forestry),
2. geography and geology,
3. mapping,
4. location of mineral resources,
5. management of water resources,
6. meteorology,
7. pollution control, and
8. military surveillance uses.

In the 21st century, many commentators have predicted that remote sensing data will become widely available outside of traditional military circles. Some are even predicting that small high resolution satellites will be launched and owned by private non-governmental entities.

The wide availability of high resolution material raises serious questions concerning just what are reasonable expectations of privacy. And if individuals have the ability to spy on governments, what constitutional, and national security, issues loom over the horizon?

Positioning

The current Global Positioning System is comprised of an array of 24 US government owned satellites (with three in-orbit spares) in orbit around the earth at a distance of 12,000 miles. The system cost the US government about $10 billion dollars. It has the capability of locating a point on the earth reportedly within the range of a few centimeters for military purposes. For commercial uses, the system has been purposely limited to an accuracy of reportedly about 50 feet. To use the system, signals from three satellites must be received, while

it is possible to receive four at once.

The system was put to military use in the recent Gulf War and proved highly successful.

With respect to commercial uses, much is in the planning stages, such as free-flight of airliners, and much is already available, owing to equipment prices having dropped below the $300 level for handheld units. In fact, moving map units are now available for automobiles in the United States and some rental car companies are offering up cars with moving map systems for as little as a few extra dollars a day.

In major metropolitan areas cars are available for rental with moving map GPS driven systems installed. Notwithstanding the warnings on the boot up screen to keep ones eyes on the road while operating the system, the effect of the unit on the driver can be quite hypnotic. There is something about seeing locations on the edges of the map well in advance of arrival at the locations depicted that can be quite distracting.

But with all the navigating through the use of the unit, there are some serious privacy issues. And these issues would likely not be discovered by the average user as it requires navigating a number of obscure menus built into the unit to become aware of the issues. As it turns out, the unit keeps a record of everywhere the car has been and its memory records typically seem to include those of numerous renters. This ability raises some serious privacy issues. One can only imagine at some point in the future, District Attorneys, and attorneys for private litigants, subpoenaing rental car, and other, movement related records associated with onboard GPS systems. And what would have happened had OJ's white Bronco had this system installed?

Also on the subject of positioning, has anyone considered what would happen if the GPS satellites somehow malfunctioned in a collective way at a time when many of the world's airliners were depending on them (assuming free flight becomes a reality) to report aircraft positions to some master computer?

Habitation

For significant manned exploration or manufacturing to take place in the next century, huge self-sustaining environments will have to be created. NASA has determined that a person needs about fourteen pounds of supplies per day to keep going -- that is, two pounds of oxygen, two pounds of food, and 10 pounds of water. That would mean that a three year trip to Mars and back for ten people would require 150,000 pounds of stores, even if no one ever took a bath! This is clearly an unacceptable weight penalty, so some way to sustain a closed loop system must be found.

As habitations become bigger and bigger, and more and more multinational in character, a question of possible sovereignty of the given space environment arises. Questions then must

follow as to how to deal with, among other things, crimes, labor, torts, families, corporations, patents and taxes.

Energy Collection

Although the geostationary orbit has traditionally been associated with communications satellites, preliminary investigations are underway concerning the possibility of locating massive solar energy based powerplant satellites in orbit. It has been estimated that a 100 km squared solar collector located in space could produce 5000 megawatts of electricity on a continuous basis. On the satellite, the sunlight could be converted to electrical energy, then to microwaves or laser beams for transmission to the earth. It has been estimated that thirty or so of these satellites could produce enough electricity to provide for all of the electrical needs of the United States.

The legal issues associated with an effort of this sort are many. The impact of the microwaves, or laser beams, of energy on the earth environment is unknown. And frequency allocation for the massive beam would have to be somehow set by international agreement.

One must also consider deprivation of light to other satellites in orbit when massive shadows would periodically envelop them. With regard to this issue, the law concerning riparian rights of landowners bordering rivers might be instructive.

Conclusion

The law is generally slow to respond to social changes. That is probably true because there is a general tendency towards inertia when a system develops over an extended period of time and when it works relatively well.

The social changes that will be brought about in the next century by satellites will be enormous. If the quality of life is to keep pace, there is no question that lawyers will have to be more like eagles than turtles.