Charting a New Course: An Advisory Overview of the Development of National Space Policy in Newly Expansive Space-faring States

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Executive Summary: The days of space as the exclusive jousting ground of the United States of America and Russia are gone, and the heavens have been opened for access by states from all over the world. As launch and operations costs decrease, launch sites become more accessible and the world becomes increasingly globalised even the smallest of states is beginning to consider the advantages that a well legislated space policy could provide. But these new adopters of space technology face a very different set of new challenges to those confronted by the early space-farers back in the 1960s, courtesy of new technologies and the changing nature of governmental and public involvement in the exploration and exploitation of the space environment.

These second generation adopters however find themselves in a position where they can learn from the mistakes of earlier policies, and can craft adaptive policies more suitable to the modern space environment, potentially giving them an advantage over those states more staid and set in their ways with rigid policies designed for an environment where governments were the dominant power in space. The article examines the new challenges facing those attempting to break in and take advantage of space, and highlights the areas and manners by which the mistakes of the past may be avoided in a modern and well written national space policy consistent with international obligations.

Introduction

The nature of the human presence in space is changing. Where once space was dominated by state-run operations, now commercial operations are becoming the norm. Where once there was an effective duopoly on space activities, now even the smallest states are beginning to take an interest in operating their own satellites. Where once costs were so prohibitive as to restrict access only to state bodies and sponsored parties, now even university research institutions can send cubesats up for research purposes. For almost forty years, the utilisation and exploration of space was a restricted field, undertaken almost exclusively by the two major Cold War powers, the United States of America (USA) and the Union of Soviet Socialist Republics (USSR), who opened up space as a new front in their long battle for dominance. The end of the Cold War and the collapse of the Soviet Union in 1991 marked the beginning of a major change. This change brought new entrants into the field of space exploration, ranging from those who have undertaken a swift turn-around in their utilisation of the arena, such as China, to those who are still merely exploring the potential that space could offer them in promoting their national interests and

providing economic advantages in the global marketplace.

These second-generation explorers have a swathe of different challenges facing them in accessing space when compared to the initial early-adopters and the approach taken to the development of policy must be different in order to adequately meet the challenges and promote the development of the safe, responsible and profitable use of space, within the bounds set down by international law. The development of national space policy is highly dependent upon the individual nation, however many elements must remain common (such as for example the separation between military and civil uses of space) with specific changes tailored to address regional concerns. The United Nations Office of Outer Space Affairs lists twenty-two nations that have developed their own legislation specifically addressing space activities,[i] however many more have legislation that is either applicable to space activities, or has peripheral effects on the future development of space capability. The need for development of further policy in many nations cannot be underestimated, and with the value of the global space economy now standing at more than USA$304bn, and still growing rapidly, legislatures and governments are beginning to recognise the rewards that a well legislated policy can reap.

Defining exactly what should class as a second-generation adopter is not always so easy, as some powers have long been active in the field, not on a sole basis but largely in conjunction with other nations, notably the UK and Canada. The legislative developments in nations such as these, the hangers-on, as we might characterise them, have been slow in coming and largely directed at the maintenance of national security and the basic licensing of satellite technologies. The suggestions made in this essay, though largely directed at those who have little-to-no legislation in the area, but are looking to expand their activities skywards, have equal application to countries like the UK, where the current legislative framework is sweeping in its nature and has much further to develop in order to exploit national space capacity to its fullest extent.

Development of Policy

In developing policy regarding the utilisation of outer space, states have traditionally had three primary concerns: national security, protection of domestic industry, and the fulfilment of obligations under international law; Different states have enacted different provisions in order to pursue these goals depending upon national priority. For those at the forefront of space activity, early legislative efforts were focused on maintaining superiority in the new frontier, and the majority of launched satellites were military or intelligence related. The pioneers of these early efforts were of course the USA and the USSR, and their approaches to legislating for space activities can be seen as what one might term "traditional space policy".

The USA and Russian Examples- Traditional Space Policy

The traditional examples used by the American and Russian governments were focussed very firmly on the 'holy trinity' of security, protectionism and compliance. Their legislation has always been dogged in its pursuit of these in various combinations. The first USA legislation dealing with space activity was the National Aeronautics and Space Act of 1958, [ii] which made no mention whatsoever of commercial interests, delegating all USA space activity to "a civilian agency exercising control over aeronautical and space activities sponsored by the United States", [iii] the National Aeronautics and Space Administration (NASA), [1] except for military operations, development of weapons systems and defence, which would be left in the hands of the Department of Defense.[iv] The original formulation of the act essentially placed a bar on the commercial use of space, not only by restricting the operation of space flights to NASA, [v] but also by ensuring that the property rights for any developments made using agency resources, on agency time, in any way connected to agency work, or with almost any other connection to the government would be the exclusive property of the United States Government.[vi] Such regulation meant not only that commercial activity would be economically unjustifiable, given that such companies would be reliant upon NASA to carry payloads into space, thus bringing them under the intellectual property regime, but also that corporations would have essentially no control over their missions. The bar on commercial development

1 A change from prior policy when it had been in the hands of the National Advisory Committee for Aeronautics

put in place by the act therefore effectively precluded any corporate involvement in space activities until the Commercial Space Launch Act of 1984 (CSLA)[vii] which amended the provisions of the earlier act. The sole exception to this was the intergovernmental consortium established by the INTELSAT Agreement and Operating Agreement,[viii] which until its privatisation (more specifically a de-internationalisation) in 2002 provided telecommunications services to over 200 countries, territories and possessions. Between the introduction of the National Aeronautics and Space Act and the amendments brought about by the Commercial Space Launch Act, legislative developments within the United States slowed to a crawl, with only enabling acts passed to ensure USA participation in INTELSAT (originally constituted as the International Telecommunications Satellite Organisation (INTELSAT)), and other commercial ventures, and regulating the access of businesses to INTELSAT facilities.[ix] Although there was a lack of further legislation, NASA itself was in overdrive, organising the Mercury, Gemini and Apollo programmes, culminating with the moon landings which placed twelve men on the moon over the course of three years.

NASA development continued in the public sphere, with little involvement from private entities, throughout the 1960s and 1970s, with notable successes being the Skylab experiments, producing the first (and to date only) solely USA built space station, and the initiation of the space shuttle programme in 1972, leading to the first launch, of shuttle *Columbia* in 1981. The turning point in the opening of USA space activities came in 1984 when President Ronald Reagan signed into law the CSLA acknowledging the ability of private actors to operate private launch facilities and spacecraft, and recognising that if the USA was to keep its place as a leader in the field it would have to begin to utilise its private industrial capabilities to conduct launches and provide commercial services. The Act marked a watershed moment in space operations, not just within the USA, but globally and constituted the first moves towards the commercialisation of space, and a shift away from the public sector domination of the field, towards a new paradigm, the idea that private entities could, and indeed would have a large and crucial part to play in the further development of human space capability.[x] The Act provided for companies to begin their own space activities, under a broad ambit, acting under licences issued by the Department of Transportation,[xi] and providing for continued inspections of facilities, vehicles, systems and payloads to ensure continued compliance with federal regulations. In addition to this, provision was made for private entities to utilise public launch facilities and "launch property" that was "in excess, or not otherwise needed for public use".[xii] This provision has proved crucial in the further development of public-private sector interactions, enabling the use of NASA facilities for launches and tests of a variety of space-craft and satellites, which might otherwise have been difficult to undertake.[2]

Licensing companies to launch craft was however only part of the USA's scheme and regulation of specific activities in space was left largely to other agencies of the USA government. Licensing of remote sensing systems, which produce data from earth observation satellites is undertaken through the Department of Commerce and the National Oceanic and Atmospheric Administration since the passage of the first Land Remote Sensing Policy Act.[xiii] The original act has since been superseded and incorporated into the federal code,[xiv] and lays down the requirements for licences for remote sensing to be issued. The primary concern of licensing for remote sensing is inevitably national security[xv] and, although this pervades all regulations, the provisions for remote sensing are possibly the most important to the USA's government, due to the potential for espionage, and photographing of sensitive and classified areas. The terms of the licence require that licencees maintain operational control over their remote sensing satellites from within the USA, and that any foreign agreements to provide data (unenhanced, or processed) to any foreign entity or authority are cleared by the Department of State. The USA's policy regarding remote sensing is based on control, by the USA authorities and by the company, and requires that the company is based (including remote ground control stations), in the USA. Certain provisions have also been put in place in order to protect sensitive allied nations, most notably Israel, which was

2 Not two hours before originally adding this comment, the author witnessed the launch of the redesigned 'Dragon' capsule on a NASA funded, SpaceX operated flight to the International Space Station from the Kennedy Space Centre at Cape Canaveral

protected from sensing at certain resolutions by the Keel-Bingaman amendment to the 1997 Defence Authorisation Act.[xvi] Justification on the grounds of national security is possibly the stand out feature of all USA legislation in this area, and the creeping paranoia that has set in through both the Cold War and in the aftermath of the 9/11 attacks would seem only have strengthened the resolve of the American government to legislate heavily for its space industry, and whilst this does seem to be working (it is still one of the world leaders), the risk is being run that eventually businesses will start to pull out of America, moving to more legislatively friendly environments to conduct their operations, and providing potential openings for newly emergent second generation nations to poach USA companies, and begin to exploit the market niches that this leaves.

Space policy in Russia followed a similar path, although with heavy influences from its specific political system. Unlike in the USA, in the early days of space travel, the USSR did not assign its space activities to one central agency, and activities were largely carried out under the auspices of the design bureaux, and the Council of Designers,[xvii] promoting fierce internal competition. Although such competition is arguably similar to that which companies engage in, no provision was made under Soviet law for private bodies to participate in space activities, partially no doubt because the Russian space programme at the time was so secretive.[xviii] Some measure of broadening of policy was made in 1971, when an agreement was signed with eight other socialist, or former socialist states to form INTERSPUTNIK. [xix] INTERSPUTNIK was an (initially) Russian controlled rival to the west's INTELSAT programme,[xx] which although they had been invited to participate, the USSR refused to take part in, citing the commercial nature, lack of legal personality, and weighted voting system used in governments as reasons for refusal. Although not commercially successful, INTERSPUTNIK has continued to exist, and at the present time has 26 member states, and provides services to 40 different states worldwide. These early efforts at co-operation and collaboration with independent entities (though it is dubious to what extent INTERSPUTNIK was in fact independent) would not be repeated until after the break-up of the USSR, and the formation of the Russian Federation.

In 1992, recognising the advantages of the American system, Russian President Boris Yeltsin broke with his predecessors and issued a decree formally establishing the Russian Space Agency,[xxi] in order to implement the objectives and requirements of the Russian Federation that would be promulgated in the Law issued in August 1993. [xxii] The legislation in Russia paid less lip-service to the international obligations and common goals espoused in the treaties, which had been placed as some of the primary concerns in the equivalent American legislation, focussing instead on the promotion of Russian interests, and the "well-being of the citizens of the Russian Federation",[xxiii] a focus which implicitly continued the former adherence to space travel as public service, above all else. The act identified eight principles, upon which Russian space activity should be based- these principles would seem to express the policy goals of the government succinctly:

- The equal rights of the organisations and citizens of the Russian Federation to participate in space activity
- Access to information about space activity
- Use of the results of space activity in the interests of customers with due regard to the rights of organizations and citizens participating in space activity
- Restriction of monopolistic activity and the development of entrepreneurial activity
- Independence of expertise on issues of space activity
- Provision of safety in space activity including protection of the environment
- Promotion of international cooperation in the field of space activity
- International responsibility of the state for space activity performed under its jurisdiction[xxiv]

The Russian policy goals are essentially all manifestations of the three primary goals, similar to the American efforts. Their ultimate direction marks the similarity, and the reason that both Russian and American efforts may be categorised together, despite their differences. Although the act permitted for the licensing of private efforts in Russia,[xxv] the establishment of an actual regime for licensing would not come about until 1996, when the Russian legislature passed the appropriate statute permitting the licensing of space operations by the

Russian Space Agency.[xxvi] The Russian approach was markedly difference from the more disparate system in the United States where licensing is undertaken primarily at the ministerial level, or, in the case of specific requirement licences (direct broadcast, remote sensing, etc.) through specialist agencies.

Although, in principle, the act opened up the Russian market to commercial entities (even foreign ones), in truth it has proved somewhat difficult for new corporations to break in to the market, dominated as it is by the direct descendants of the design bureaux. In the immediate aftermath of the centralisation of policy, the domination of the previous system overshadowed efforts to modernise it,[xxvii] and many of the smaller design bureaux survived only by international interactions which took them away from the confusing environment where "military involvement remain[ed] high and out of civilian control",[xxviii] a situation which has produced some of the great success stories of the modern space industry, a notable example being the Lockheed-Krunichev-Energia joint venture which became International Launch Services and has launched over 390 commercial and state payloads into orbit since 1995. [xxix] Although it has undergone crises, the Russian space industry would seem to be booming, particularly in the area of launch services, and the modernisation of the commercial exploitation of space is one of the key targets of the current government.

It would seem that in both the United States and Russia where the legislative framework is built around state controlled exploration, and heavily controlled and licenced private operation, that there is some degree of success, largely built on their pre-existing provisions and experience in the field. Although this provides them with a large advantage in the future use of space, with more and more countries looking to break into the area, their long-held perceived right over the use of space is going to be challenged, and with clever legislative action, and a firm policy in place, there is no reason that other regional blocs, and even independent states can't hold their weight in the arena.

The UK Model- Outer Space Act 1986

The United Kingdom has always been heavily involved in the space industry, however its participation has largely been on the 'coat-tails' of greater space-faring nations. Although several decades ago there were some tentative moves towards greater independent involvement, a lack of political will and motivation means that only one launch that could be said to be entirely British in its nature was ever made, that of the Prospero satellite by a Black Arrow rocket in 1971. Interest in space activities was largely restricted to military and intelligence uses and the commercial sector remained a wasteland. The UK, it appeared to the governments at the time, had very little to offer to the space industry. The one exception to this that the administration saw was the provision of satellite tracking data and facilities which were provided via the telescopes and instruments at installations such as Jodrell Bank and Goonhilly. In 1985, the British National Space Centre was established to co-ordinate British civil space efforts, primarily in the fields of research, communications and navigation systems. The Space Centre was largely a collaborative effort between research councils, government departments and international organisations, but the general disinterest in the effective use of space was apparent, not only in the limited budget of the organisation (which at the time of its dissolution in 2008 stood at £268m, mostly contributed by the former Department of Trade and Industry),[xxx],[xxxi] but perhaps more notably by the lack of a permanent staff. Besides the Administrator, and certain other members of senior staff, the Centre was staffed exclusively by around thirty civil servants on rotation from other departments. Although it was the third largest contributor to the budget of the European Space Agency for a time, the refusal of the Centre to join the International Space Station project (which was rejected as not being good value for the money),[xxxii] and the stated policy of the agency against human space flight [xxxiii] effectively side-lined it when it came to major space projects beyond Europe, whether national or international. By this time it was largely acknowledged that the UK could not be a major player in the public sphere, but governments were beginning to come around to the idea that the UK could pull its weight in the private sector and, in 1986, the Thatcher government passed the Outer Space Act (OSA) that would lay the foundations for the future of British space activity.[xxxiv]

The act dealt primarily with licensing arrangements. Licencing was to be undertaken through the

Department of Trade and Industry (a now defunct department), which was ultimately replaced with the Department for Business, Innovation and Skills, and was at the discretion of the Minister responsible. Licensing conditions were loose, but notably required that flights be undertaken in such a manner as to "avoid the contamination of outer space",[xxxv] and had adequate provision for the disposal of the satellite once it had completed its task.[xxxvi] The act also imposed the duty, and implemented the international requirement that the Secretary of State kept a register of British space objects,[xxxvii] which up until this point had been an ad hoc matter, given the limited involvement of the UK in space matters.[xxxviii] The passage of the Outer Space Act, and its extension to the Channel Islands,[xxxix] [xl] Isle of Man[xli] and Gibraltar[xlii] by order-in-council would, it was hoped, create a friendlier environment for investment and development of the UK space industry, and help to overcome the administrative apathy that had up until that point characterised the UK's involvement.

It did not take long for commercial interests to begin to take notice in the potential afforded by the UK, which had the advantage of being a stable state, geographically and politically close to both the USA and the European nations, and, slowly but surely, the industry began to develop. A major step in the development of British involvement came in 1991 when Helen Sharman became the first British citizen in space,[3] funded by a consortium of private backers, who paid for a place on a Soyuz flight to the Mir Space Station. This collaboration, known as Project Juno, proved private interest in space investment in the UK, and drew much public attention at the time.[xliii] A second major change in the British space industry came in 2010, when the British National Space Centre (BNSC) was closed, and the new United Kingdom Space Agency was founded,[xliv] taking over responsibility not only for all the previous responsibilities of the BNSC, but also funding for new projects, control over British elements of the Galileo satellite navigation system, and government space policy.[xlv] Alongside the creation of the Space Agency came the creation of the International Space Innovation Centre in Oxfordshire, a new research facility, built as a collaboration between government (providing £24m of funding) and private industry (providing £16m of funding) and creating 7000 new jobs.[xlvi] The expansion of the British space industry, and the government's apparent newfound faith in space was compounded when figures were released, revealing a £9bn contribution to the economy, and the presence of more than 70000 jobs directly related to it.[xlvii] The recent coalition government has reiterated its dedication to the future development of the British space industry and, in a marked contrast to the current policies of other space faring nations (most notably the USA), has not only earmarked additional funds for development of new technologies, but also announced an intent to reform the Outer Space Act, in order to bring down insurance premiums, and to generally make the UK more attractive for developing firms.[xlviii] The 10% annual growth rate,[xlix] it would seem, is inspiring the UK Government to change its opinions and take advantage of the rapidly expanding commercial space sector.

The UK is what we might characterise as an early-adopter, second generation space faring nation, and although in the past there has been a tendency for stagnancy, the framework laid down in the Outer Space Act has paved the way for the current swathe of policy developments and rethinks. Although there are many deficiencies, and reform is needed, the existing legislative framework at least provides a foundation upon which future development may be laid. The broad nature of the Outer Space Act has both helped and hindered its progress, and future legislative reforms will need to take into account new and developing technologies in order to continue the stated desire for continued expansion.[l] The nature of the current formulation of the act possibly lends it some advantages over the older and arguably more developed positions that the USA and Russia have taken. As well developed policies, with a comprehensive legislative framework backing them, the traditional model is perhaps significantly less responsive than the British model, which can, for the moment be more reactive, and adapt more readily to changing situations. In this respect, the model embodied by the Outer Space Act may be more appropriate for the second generation explorers, in light of the rapidly changing nature of the industry, allowing them to more readily integrate and utilise new technologies to their full extent.

3 Sharman was selected from a list of candidates who replied to an advert saying 'Astronaut wanted, no experience required'

New Challenges for Second Generation Explorers

The second generation adopters, both those that are looking to build on their existing economies (like the UK), and those who have yet to develop any particular economy in space, face a different set of challenges to the first generation. Whereas the senior space-faring nations had obstacles of technology to overcome, the new challenges for nations can be found in co-operation between government and industry, and in making effective and efficient use of funding to boost local and regional economies. Beyond this, the space industry is already a crowded market, and for states looking to break into such a market, newly developed policy must provide strong benefits and incentives to secure both outside investment from pre-existing users and to promote new and local start-ups. For powers where much space activity is conducted through a regional body (notably European powers that subscribe to the European Space Agency), an effective integration of both national and international space programmes must be undertaken, an integration which, if backed by strong legislative action, could do much to expand opportunities, and to promote international collaborations and projects between industry and other bodies. Legislative action must not only be geared towards industry however. In addition to this it should promote research and development, through universities and research establishments, to further develop and enhance capabilities. National security will also remain important, and so the establishment of an appropriate regime for remote sensing and telecommunications must also be a priority.

Future of Space Policy in Expansive Space Faring Nations

The key problem with the legislation of many modern space states is that their legislation was not written with the prime concerns of businesses and investors in mind, instead much was written at a time when commercial interests were very much at the periphery of space users, and the long-term result has been what Handberg characterises as private enterprise "becoming hostage to [the] peculiarities and problems [of the public sector]".[li] For newly expansive space-faring nations, or those that are entirely new to the field, given the change in the nature of space activities, it can be regarded as nothing less than essential that legislation is of a form that will enable close collaboration between government and corporate interests, and the promotion of industry and enterprise in the sphere of outer space. In this manner, they may have an advantage of kinds over the original space-faring nations, in that they can write legislation from the beginning without needing to adapt it to fit a pre-existing framework.

Facilitation of International Cooperation

As a key part of the modern globalised economy, policy to facilitate international trade must play an essential role in the development of space industry economies in states which have yet to develop capacity. For many, a certain degree of international trade is critical as many states do not have the facility or capability to conduct independent launches and must rely on services provided largely through the Russian, European, or American systems. The ability to capitalise on these systems whilst retaining independence must be carefully balanced against the danger of over-reliance upon others in development. USA policy has been characterised by protectionist stances, and litanies of regulations on what may and may not be traded. Restrictions on foreign ownership in the USA system arise largely with the issuing of licences for radio communication, an essential part of satellite operations. Although the CSLA placed no direct restrictions on the foreign ownership of companies operating under its auspices, the requirement of a licence from the Federal Communications Commission (FCC) to operate communications systems places requirements similar to those levied upon the airline industry. FCC regulations stipulate that no licence shall be granted to or held by "any corporation of which more than one-fifth of the capital stock is owned of record or voted by aliens or their representatives or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country."[lii] This restriction by the back-door has the effect of essentially limiting operations to USA corporations and actively preventing foreign investment in USA companies. Although many USA companies have prospered, a lack of foreign investment due to this and the highly restrictive International Trade in Arms Regulations (ITARS), which strictly limit the trading of satellites, subsystems, launch vehicles, ground control equipment, and technical data,[liii] to those parties pre-approved by the Department of

State, has made a large contribution to the 33% fall in global market share for USA satellites,[liv] since the addition of satellite technology to the ITARS in 1999.[lv] Although recent legislation in the USA has provided for the relaxation of these requirements with regards to satellites[lvi] at the discretion of the White House,[lvii] a measure that was subsequently granted for certain earth-orbiting satellites and technologies (with some restrictions on exports to sensitive countries such as North Korea, China and Iran),[lviii] it remains to be seen how long it will take the USA to recoup the estimated $21bn that it lost between 1999 and 2009.[lix] The USA model then would not seem to be suitable for up-and-coming new entrants. Whilst the large USA companies are capable of absorbing the consequential costs of these restrictions, smaller corporations cannot, and there is evidence that the strict export/import regulations proliferated by the American system have a deterrent effect upon potential consumers.[lx] Indeed, some companies in Europe have even been using the lack of restrictions as a selling point for their own technologies.[lxi] For those states hoping to develop their own industries, a careful application of restrictions to specific systems would seem to be advisable, taking a metaphorical scalpel to security-sensitive areas, rather than the equally figurative hammer that seems to have been favoured by the American approach, in order to promote international investment and the profitable international sale of goods and services, without placing blanket restrictions on the transfer of technology and data. An approach which does not effectively restrict the amount of foreign investment in corporations would also seem to be in order, as an action again of encouragement, rather than censure against influxes of money from foreign sources.

Liability and Insurance Limitation

Although private enterprise acts essentially as an extension of government in outer space, with states being ultimately liable for damage caused, the ability of corporations to conduct independent activities and projects must not be stymied out of fear of liability. The usual way of bypassing this issue is with the inclusion of provisions within legislation requiring the reimbursement of governments for any liability based charges incurred,[lxii],[lxiii] often in conjunction with a requirement for insurance to be acquired by the entity. Differences arise with regards to the nature of this insurance. Within the USA the value of the insurance required is determined by the Secretary of Transportation in consultation with NASA and "the other appropriate executive agencies", which might be used to fully reimburse the USA government for any costs incurred.[lxiv] In the United Kingdom there is no such specification, and the amount required is left to the operator.[lxv] Curiously, the Russian equivalent legislation does not explicitly provide for compensation by the state, instead clarifying that the state "guarantees" full compensation,[lxvi] alongside a statement that the payment must come from the operator.[lxvii] This arguably more direct approach disguises the fact that under international law the system would operate in practice in line with the state paying compensation and itself being paid by the operators. This approach, in the formulation taken by the USA and UK would seem to be the most desirable and logical approach, and would seem to be suitable for even emergent powers. One critical point however must be made. The conditional imposition of liability limits is found in both the American[lxviii] and Russian[lxix] systems, but is notably absent in the OSA, which renders liabilities in the UK essentially unlimited, a decision which significantly increases insurance premiums for UK companies, when compared with those for international companies constituted in jurisdictions where liabilities are limited. This would seem to be one of the key prospects for reform of the OSA,[lxx] and the imposition of liability limits would seem to be advisable in any jurisdiction in order to prevent prohibitively high insurance premiums (particularly in states looking to involve themselves in space tourism activities).[lxxi] The value of these limits should be delicately handled, to weigh the potential damage that could be caused by each launch and object against the interests of promotion of business with limits that should not be crippling to potential local entrants into the market, in what is already an incredibly expensive area to be in. For the purposes of fairness and inclusivity, consultations with pre-existing foreign corporations (both those that may be interested in making an entrance in the state in question, and those that have no such interest), local research institutes and universities, insurers, and public interest groups would seem to be the most appropriate method of determining said limits, rather than the method favoured in the American system, wherein the Secretary of Transportation sets limits based only on consultation with government

agencies. The alternative approach involving a greater degree of consultation and co-operation would provide vast advantages to those states looking to create new models, enabling parties with interests in the area to contribute to the effective development of space policy, in a manner which is not provided for in the USA legislation. Caution must be taken however to avoid direct interests from having too much power in the decision, so suggestion would be made that the final limits on liability should be determined by the relevant minister, with the requirement for consultation also to be included in the legislation to guarantee protection under relevant administrative law.

Funding of Space Activities

Government funding of space activities and the creation of funds and grants for the promotion of space activities must play a large role, particularly in the early stages of any new entrant onto the space scene. Research and development grants will be particularly important in encouraging universities and research institutes to participate in the new frontier. Whilst corporations and private profit-making entities are capable of drawing in their own investment, and resources, the oft-strained finances of academic institutions will often not easily allow for direct involvement with national space enterprises, a situation which can have an inhibiting effect on future development and growth. Although the growth in the "cubesat" (varyingly called micro-satellites, cubesats [4] or miniaturised satellites) industry has brought costs down significantly, sometimes to levels at which institutions may be able to have some involvement, the cost of launches remains prohibitive, and university projects in the cubesat sphere are still largely restricted to government operated missions which smaller projects can 'piggyback' off. Recognition of the value of government investment in private research and development can be found in the American system, where the ability to provide grants to co-operating organisations is enshrined in legislation,[lxxii] and can provide much needed funding to developers and entities looking to expand their operations. An increase in funding to academic institutions should not be seen to have only intellectual value however. Profitable enterprises are more than capable of rising from these arrangements, a particular example in the UK being Surrey Satellite Technologies which started out as a company owned by the University of Surrey for the development and manufacture of satellites[lxxiii] before being sold off to EADS Astrium in 2008.[lxxiv] Even in situations where profitable enterprises do not arise, the reinvestment of technological advances in future development has a positive effect, which is especially useful to expansive states looking to carve themselves a niche in a crowded market. For more commercial enterprises, an increased availability of tax breaks, and possibly some degree of support with regards to liability would serve to make nations more desirable as host states for businesses.

New Markets and Space Services

The business of a market which is still largely dominated by two main players (conceivably three if the ESA is included) presents an intimidating challenge to those states that are looking to break into it. The encouragement of innovation at the hands of almost any prospective participants would seem to be the most likely way for these second generation states to manage to enter. The exploitation of flaws in the American import system has already been demonstrated (see above), and the identification of new opportunities must be undertaken in order to expand industry. For countries with free space, the establishment of commercial space ports would seem to be an obvious opportunity, albeit one limited by demand and land availability. Several governments have already begun to consider where they might expand in this direction, notably Scotland and Sweden,[lxxv] who are already vying to host Virgin Atlantic's European jumping off point. The signature of an agreement between the Swedish government and Virgin Galactic in 2007 was hailed as a major turning point in Swedish policy and included a promise to develop a regulatory environment similar to that of the USA to facilitate the transition.[lxxvi] Although there seems to have been no further movement in this direction from the Swedish government, announcements have been made indicating that the first flights of SpaceShipTwo from Kiruna [5] may commence as early as 2015.[lxxvii] Given the lack of

4 Cubesat' actually refers to a specific subset of these, namely those satellites which have a volume of $10cm^3$, although it is also used in general parlance for any satellite of a similar size. It is in the second context, as shorthand for its class that it is used in this essay.

5 The site intended to become 'Spaceport Sweden'

regulation however, this target appears on the face of it a little optimistic. Other launch facilities and opportunities to provide launch services are apparent, if only in the lack of them. The only marine launching facility, SeaLaunch, has proved to be successful with only four failures in thirty-six launches,[lxxviii] and further opportunities to establish similar entities would appear to be available to coastal states. In areas such as this, a lack of competition would seem to invite entrants to make their own contributions in pursuit of profit. The provision of launch services closer to home could potentially draw some degree of investment from the EU and ESA, as it would reduce the transport costs of having to ship components, staff and equipment to French Guiana. Enabling the construction of space ports should be undertaken in much the same way as airport construction from a legal perspective, and should attempt to draw in investment not only from industries directly related to the space activities due to be performed, but also from other entities, who may be able to provide services to satellite uplink systems and facilities. In this manner, the development of spaceports should not only provide advantages to the space sector, but also other economies locally. [lxxix] The need to separate space ports from major population centres cannot be understated, and principles on siting of spaceports ought to be adopted by any government thinking of undertaking their construction, even if these are do not become codified law. Issues about siting restrict operation of space ports to those nations with much empty and unused land, but for those nations, the construction and operation of space ports and accompanying services peripheral to launch could be an immensely profitable venture.

Disposal of Satellites and Space Junk

The issue of what happens to satellites after they have completed their missions and the problem of space debris and abandoned satellites is one that has also come to the forefront in recent years, and measures to prevent the pollution of the outer space environment have become commonplace in legislation. The manner in which this is achieved is variable. The USA requires no promise of responsible disposal as a default in its general licensing provisions, although as terms in licences can vary, it is possible that individual licences may require this. There is, however, a requirement in the FCC regulations that before a licence shall be granted a comprehensive analysis of the risk that a satellite will become debris during its operational lifespan,[lxxx] the risk of it creating debris,[lxxxi] and the post-mission disposal plan, including the risk of human casualties should the satellite not entirely burn up upon re-entry shall be presented before the Commission.[lxxxii] Although the FCC regulations do not require atmospheric re-entry as the disposal method, that the procedure is detailed specifically may suggest that this is the preferred method, a method which would seem to be borne out by the USA Government Standard Practices for Space Debris Mitigation, [lxxxiii] and the USA National Space Policy. [lxxxiv] The standard practices stipulate three distinct methods for disposal,[6] and also include a requirement that disposal is done in a "cost-effective manner". The addition of this requirement is a slight complicating factor, albeit one that is unlikely to cause much trouble, given that in the private sector as well as the public- there is a constant desire to keep costs downt.[7] The USA approach to space debris mitigation has been mirrored in slightly more truncated manner in the OSA. The OSA addresses the issue of space debris and pollution of the outer space environment in two sections with regards to licence conditions, firstly stating that licencees must operate in a manner so as to:

> "(i) prevent the contamination of outer space, or adverse changes in the environment of the earth,
> (ii) avoid interference with the activities of others in the peaceful exploration and Use of outer space,
> (iii) avoid any breach of the United Kingdom's international obligations, and
> (iv) preserve the national security of the United Kingdom"[lxxxv]

Before addressing the issue of post-mission disposal, the method of which may be a condition of the licence, with a stipulation that the Secretary of State must be notified of disposal as soon as is practicable. [lxxxvi] The typical example licence published by the UKSA does not in fact include any particular provisions on disposal, only that operations are carried out in line with "best practice

6 Atmospheric re-entry, manoeuvring to a storage orbit/heliocentric orbit or retrieval

7 Compliance with the standard practices is mandatory only for government launches, or government procured activities

in the space industry,"[lxxxvii] although it is likely that the existence of a disposal plan is in fact a pre-condition of the licence. It seems likely that any reform of the OSA should clarify this and make the responsible disposal of satellites a statutory requirement for the issuing of a licence, as opposed to the discretionary requirement it is at present. Making responsible disposal mandatory would seem to be the most reasonable course of action, particularly given the recent introduction and endorsement by the UN of the COPOUS Debris Mitigation Guidelines.[lxxxviii] Although at present these are just guidelines,[lxxxix] it would seem both apparent and logical that in any future treaty that may come about, standards similar to these will become mandatory for state parties, and a degree of pre-emptive legislation nationally in favour of applying stricter standards for the preservation of the outer space environment would seem to be advisable.

Challenges for European States

For European countries in particular, where much activity is conducted under the auspices of the ESA, an effective integration must be achieved between national space activity and international space activity. It is important to retain independence of character in all economic activity, and though the European Space Agency provides a beneficial forum for the conduct of international activities, its commercial value is strictly limited, a situation which may change if, as the European Commission hopes, the ESA is eventually brought within the purview of the European Union as an agency within the current EU system. [xc] The current system, whereby the ESA is funded through contributions from member states (and from the EU)[xci] via their own national space programmes would seem to be effective and has ensured ESA collaboration on many important research projects. Any legislation by European states would need to preserve this funding, in addition to expanding its' own. The EU has recognised this need, stressing that with intense competition from Russia and the USA, as well as increasingly India and China,[xcii] a concerted effort is needed within the European bloc to retain its place as a leader[xciii] and the provider of 40% of the world's satellite services.[xciv] A joint resolution[xcv] has been promulgated to ensure further co-operation between the EU and the ESA to this end. The risk of national space activity being subsumed under the weight of EU bureaucracy would seem to be somewhat mitigated by the fact that space is one of the "shared competency" areas within the EU where, as outlined by the Treaty on the Functioning of the European Union: "Union exercise of competence shall not result in Member States being prevented from exercising theirs." [xcvi] This exclusion is important, as it ensures the continued development of national policy, separate from, and in addition to, EU policy, an endeavour which will prove vastly beneficial to national economies, enabling states to pursue their own economic advantage, whilst sharing the benefits peripherally with the Union itself. Legislating in support of space policy objectives should retain a clear distinction between national space policy and European space policy, which increasingly coincides with the policies of the ESA. The complete benefits of a national space industry can only be fully exploited within the national perspective, although as previously stated the ESA provides excellent provision for international projects and endeavours, within the sphere of national policy, it should be retained as a facilitator for launches and similar services.[xcvii] This continued provision of such services by the ESA should be exploited to its full extent by nations within the bloc, although a division between the funds being handed to the ESA, and those given to national space agencies and ventures should be clearly drawn, something which does not appear as yet to be being done, as interactions and funding of the ESA is done through the national space agencies. Whilst this is an appropriate arrangement, the creation of a separate fund for the purpose of providing stimulus to national space projects upon application would seem to be a positive development in a manner similar to the "Space Transportation Infrastructure Matching Grants" provided by the USA government.[xcviii] Unlike the USA grants however, these should be available to all space services, not merely in connection with the transportation aspect.

Remote sensing and Communication Allocations

In addition to all the aforementioned provisions, accommodation should be made for either a reformulation, or the formation of a comprehensive policy on remote sensing. The prime concern with remote sensing is of course one of national security, and the prevention of the release of sensitive data, an understandable concern in a world which besides being continually beset by conflict is also becoming

increasingly internationally competitive. The American system, wherein blanket licensing of all systems is required [xcix] is no doubt effective in securing the nations sensitive areas, but it also provides a sizeable barrier to companies that may wish to invest in American earth observation systems. The adoption of a regulated, but more liberal, approach would seem to be warranted for anyone who wishes to draw investment into this field, whereby licences would only be required for those satellites which have "enhanced capability", or reach a certain threshold in their capacity to take images. Government regulation of data availability should extend only, and no further, to restricting the sale of data which is of greater quality than that already freely available, and of requiring the censoring of particularly sensitive areas such as military installations, and other security sensitive buildings/areas. By implementing these suggestions, not only can governments save time on issuing licences to satellites which do not have any realistic capability to cause security damage, but also ameliorate any potential dangers, without seeming to be overly cautious, and deterring investment because of fears over restrictions of data sale, and subsequent loss of profit.

The use of radio frequencies must also be examined carefully, not so much for the purposes of compliance with international law, but more for a thorough analysis of the efficiency of spectrum use. The radio spectrum is not unlimited, and the number of operators looking to use it is only increasing, in some cases to levels where the current growth rate is unsustainable in the long term. Ensuring efficient use of radio frequencies is the only way to prevent a catastrophe, by ensuring and applying the mantra that each should use only what they need, and no more. Unused frequencies (whether publicly or privately allocated) should be re-allocated to those who can make best use of them and, in cases where different providers are bidding for the same spectrum allocations, a public interest standard should be applied to determine who should secure them. Traditionally frequencies, when they become available are auctioned off.[c] There are problems with this tactic however, in that, although it can secure large amounts of revenue for governments, it effectively restricts the acquisition of frequencies to larger pre-existing companies that have the financial resources to outbid their competitors. This restriction is counter-productive in states that are looking to promote the expansion of industry within their borders and, though it should not be abandoned entirely as a system, it should be used only in cases where the public interest in favour of multiple users is deemed to be equal, and another method is required to determine how frequencies should be allocated.

Legislating for New and Emergent Technologies

A certain degree of anticipation should also be present in new legislation. The rapid development of new technology and the changing environment has introduced new and hitherto unaddressed challenges to existing legislation which they are not equipped to adequately deal with. Once again the advantage of the second generation of space-faring nations shines through. In having no pre-existing legislation, they can start from a position where they take into account the challenges that are tripping up the older, more heavily regulated powers. In addressing these new concepts in space design and practice from the start, not only can they effectively utilise the changes from the start, but they also have an advantage in discovering new niches and areas that the original explorers will be unable to exploit thanks to their top-heavy and cumbersome legislative frameworks. This paper does not attempt a comprehensive overview of this area, but will present some (brief) thoughts below. The challenges in this area can largely be divided into two primary categories: new and emergent technologies; and new or developing industries. Each comes with a unique set of challenges that must be addressed by the forward thinking and on-the-ball legislator.

Of perhaps the most immediate concern are the technological developments that nations are facing. It is a fact that only a certain degree of anticipation can be made in this field, but from the paths that have already been trodden there are certain reasonable assumptions that can be made. The miniaturisation of technology has increasingly brought about smaller and smaller satellites, and an increasing focus in some sectors on the use of these devices. Particularly popular with research institutions and universities, thanks to their use of off-the-shelf components and their lightweight nature[8] which keeps launch costs down to a level

8 A typical cubesat will not exceed 1.5kg

that one can at least easily conceive of,[ci] the technology is advancing in leaps and bounds, but brings with it a swathe of issues for legislators, that as of yet have not been addressed. The characteristic nature of cubesats and other miniaturised satellites is that of transience. Due to inherent of limitations on power and capacity, cubesats have a limited lifespan[cii] and, subsequently, tend to have shorter mission durations in which to perform whatever experiments that they are required to.[9] In addition to their shorter lifespans, there are projects underway, and some launches have already taken place which involve the en masse launch of many cubesats, the most notable planned project being the Von Karman Institute's "QB50" initiative, which would involve the launch of fifty networked cubesats, built at different universities globally, in order to conduct both measurements in the thermosphere[10] and re-entry experiments.[ciii] At present, the same regime is applied to these small satellites, as to regular satellites, a decision which seems questionable at best, akin to applying the same laws governing public bonfires to the use of a lighter in public. This presents a problem not only when it comes to size, duration of mission and lifespan, but also in relation to the fact that many cubesats (particularly those involved with remote sensing activities) simply do not have the capacity to conform to the more restrictive and specific requirements on focal length and resolution that larger satellites do. The development of a new regime within national jurisdictions, whereby 'short-term licences' are given, not for one satellite, but for an entire network, under different conditions to a 'standard' licence, perhaps with more discretion when it comes to individual functions, might be more appropriate. If done hand in hand with a form of 'enhanced liability', meaning that liability is shared by the entire constellation rather than by individual institutions providing the satellites could encourage the proliferation of this new technology. The use of cubesats is not limited to private institutions however,[civ] and increasingly government agencies are beginning to deploy them for experimental purposes. [cv] With ever more developments in nanotechnology, the future of such satellites for which there is 'no separation between platform and payload'[cvi] would seem to be secure. Cubesats often share radio bandwidth with amateur radio operators, who were themselves some of the very early adopters of the technology. Although, for now, this seems to be an appropriate regime, as more and more microsatellites are launched and the radio spectrum becomes ever more cluttered, it would seem that at some point in the not too distant future, a separation of the spectrum will become necessary and the assignment of dedicated bands to cubesats will be desirable. For nations starting out in the space industry, which may see cubesats as a simple and cost-effective way of entry into the industry,[cvii] this should be done at an early stage, so as to not bring about confusion later on, and to provide a clear distinction between band rights and spectrum users. The advantages of a less restricted import/export system also show here: in the USA, some universities have had problems with students being unable to work on cubesat projects, as a result of the restrictive conditions laid down in the ITARS, a situation which, as has already been suggested could be avoided by the implementation of a less strict system from the start in countries that have yet to develop a coherent or comprehensive space policy.

New space services are perhaps more easily legislated for. The increasing interest in space tourism has been joined by early moves in the direction of point-to-point suborbital flight, as well as some basic interest in the idea of resource extraction in space. All three of these issues could constitute a paper entirely of itself; however some basic functional suggestions might be made in order to provide a regulatory framework within the national sphere to at least enable some initial development in these areas.

Another industry which is beginning to emerge is the idea of on-orbit repair and maintenance, long the preserve of government agencies alone. [cviii] Approaching this under national law and policy should be done in much the same manner as one would for remote sensing or broadcast. A base arrangement and licence, with additional licensing conducted specific to the purpose. Additional licence provisions should include the manner in which disputes should be conducted, whether they are carried out under standard contract law provisions based on the contract between the servicer and the serviced, or whether a different regime is to be

9 An average mission duration for launches so far is around 6-12 months

10 60-380km

applied, given the unique nature of the project. Approaching the matter under standard contract law would seem to be appropriate,[cix] however there are additional risks. [cx] If the servicing satellite accidentally detached a non-vital piece of a satellite, which then hit another satellite, destroying it, should liability lie with the owner of the satellite being serviced, or with the provider of the servicing? A standard reading of present law would imply that liability should lie with the owner of the satellite under maintenance; however this would seem to be manifestly unreasonable if the maintaining satellite is the one that causes the actual damage. The adoption of a fault based standard on which this could operate would seem to go some way to addressing this issue, though it does leave open the problem of unavoidable damage, and possible joint liability issues if no fault can be ascertained, which is a distinct possibility given the difficulty of collecting evidence in space.

Point-to-point suborbital transport is a matter that will largely have to be addressed by the international community, likely through the International Civil Aviation Organisation, however there are some matters for which national legislation may be required, notably the imposition of safety standards and restrictions upon sound interference, particularly problems over allowing sonic booms above land. Given the speed, and range of such projects, the use of them within national boundaries would seem to be rather a waste and unlikely (except maybe in sizeable countries like Russia). Whether they would require licensing as space objects would also be a matter for debate. It seems likely, particularly in heavily regulated states that a requirement for licensing as space vehicles would be necessary, even if they did not make orbit, in order to prevent confusion over the jurisdiction under which they should fall.[cxi]

Conclusion

The second-generation of space-faring nations is in a vastly advantageous position over their distinguished forebears, from a legislative policy standpoint. The ability to either draft from scratch, or update an existing loose legislative framework (like the UK) has the potential to provide great advantages to these states, economically, scientifically, and developmentally; advantages which should be seized with both hands. With the space industry ever growing, the time would seem to be right for new entrants to establish themselves as key players in this new game of chess, and to begin to forge their place amongst the community of space-faring nations. The responsibility is on the legislators to create an environment which is conducive to commercial, academic, and governmental uses of outer space, in which companies can flourish, and the continued growth of the space economy can continue, both at a national and a global level.

Over the course of this overview, we have seen many key areas in which newly expansive states can learn from the lessons of the past, and create a use of space based not on the old ideas of dominance and superiority, but on cooperation between governments, between governments and private industry, between governments and academic institutions, and between governments and regional and global projects. Only with such cooperation can humanity begin to utilise space to its full potential and begin to live up to the expectations of space as the 'common heritage of mankind' that have long been held. It would seem that those governments which hitherto have only had a very limited involvement in space are beginning gradually to become receptive to the potential national advantages that more effective and efficient use of outer space could have. We can but hope that as they do, these forward thinking legislators will act in a responsible, profitable and reasonable manner as together we move together into a new space age.

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