

A NEW EUROPEAN SPACEPORT

LAW AND POLITICS IN SPAIN

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Introduction

The development and expansion of commercial human spaceflight requires legal and regulatory mechanisms to provide a robust framework under which commercial operators can fly paying participants. The term ‘participant’ is specifically chosen as opposed to ‘customer,’ as it is the term used in FAA regulation in order to distinguish them from ‘passengers.’ FAA documents state, “*Space flight participant means an individual, who is not crew, carried aboard a launch vehicle or reentry vehicle.*”

Currently, only the United States has specific national legislation to govern this new activity with the mandate to promote the industry. Spain, to the contrary, has neither a national space law nor a clear legal framework under which commercial space launch services could be regulated. This

chapter investigates under which legal basis a suborbital spaceflight operator might proceed to obtain a launch license to operate from the airport in Saragossa, Spain.

Following a brief technical overview of the Saragossa airport, this chapter analyzes the potential regulation of this industry and presents reasons why Spain, and not Europe, holds the competence to legislate in this domain.

The creation and development of a new high-technology industry needs a clear regulatory framework and market rules in order to develop. The legal framework necessary for suborbital flight operations will facilitate regional and industry-wide economic development for a dynamic and infant industry that commercializes technologies largely developed under public funding similar to recent examples such as the Internet and radio-navigation.

Three legal frameworks are suggested for how to operate a commercial spaceflight service under the supervision of the Spanish government. These are:

1. Operate under a yet to be defined national legislation;
2. Operate under a yet to be defined bi-lateral agreement between the U.S. and Spain which gives the FAA Office of Commercial Space Transportation jurisdiction over commercial space launches on Spanish territory; and
3. Operate under the existing Spanish aviation law with interpretations and additional rule making.

In addition to a literature review, I conducted semi-structured interviews with experts in the field to understand the feasibility of each approach, and to gain additional knowledge and breadth surrounding the topic. The results of the interviews were analyzed in concert with the literature to identify the strengths and weaknesses of each legal approach.

The role to be played by the autonomous community of Aragón, and other competent government organizations, is also briefly explored. The chapter concludes with a discussion of the probable means to implement the legal framework, and presents recommendations for additional research towards enabling commercial human suborbital spaceflights from Saragossa.

The Emergence of Space Commerce

Space tourism is an emerging segment of the adventure travel industry aiming to open space flight to civilian participants as a commercial service. These new space launch services cater to a wealthy subset of the general public but are intended to eventually serve the middle class tourist when launch costs drop as a result of expected operational efficiencies and

economies of scale. Many high technology entrepreneurial companies are moving to exploit this emerging market by developing rocket powered vehicles to take participants on an out-of-this-world experience to the edge of space. In addition to participants, there is also significant potential to fly research payloads on these same vehicles.

The development of security benefits and spin-offs are expected, following significant private investments under expectations of a promising and dynamic market. Quantifying direct and indirect benefits for such an infant industry is a challenging task at this stage, but it is clear that they may be significant. Market studies predict that by 2010 suborbital tourism could achieve between less than \$700M and over \$1.1B, depending on passenger 'fitness' requirements and restrictions.³⁵

The commercialization of technologies with public heritage has created flourishing new industries and value added applications such as the Internet and radio-navigation, and health, safety and operations regulations of a clear and unambiguous nature have done much to benefit the development of the now global aviation industry. Hence, it is our view that market growth for the commercial space industry is to a significant degree dependent upon the capacity and willingness of states and nations to provide an unambiguous legal and regulatory framework for operations.

These are challenging times for economies and regulators alike, and novel arrangements are needed to assist novel industries and the diffusion and applications of innovation. Despite the challenges associated with estimates of the future market, it is clear that this is a strong indication of how important it is for the state to analyze and act in its role as the facilitator of sustainable economic development. A clearly defined and safe operations framework benefits the industry as a whole and is an obligation that the state must fulfill.

Indeed, space commerce is experiencing significant development in the United States and throughout the world, facilitated to various degrees by legal initiatives. In the United States the Federal Aviation Administration (FAA) holds the authority to regulate commercial spaceflight through the Office of Commercial Space Transportation (AST). The U.S. Congress, via The Commercial Space Launch Amendments Act of 2004, furthered the AST's regulatory authority with the specific intention *"to promote the development of the emerging commercial human spaceflight industry."*¹

In addition to the U.S. federal government, various state and local governments are passing laws to provide tax relief, implement liability limitations, and develop spaceport facilities for the benefit of commercial launch providers and as incentives to locate in their jurisdiction. These governments intend to benefit from economic development through high paying aerospace jobs, tourism visits, and ancillary services. The principal commercial spaceports actively courting spaceflight operators include:

Spaceport America, New Mexico; the Mid-Atlantic Regional Spaceport, Virginia; Space Florida for Cape Canaveral and Jacksonville; Mojave Air & Space Port, California; and Spaceport Sweden, in Kiruna. Numerous other spaceports are conducting preliminary investigations to establish the economic and technical feasibility of their facilities.

Although seven European nations have enacted national space legislation,² these are not as comprehensive nor as pro commercial as the space legislation found in the U.S. European governments are taking a more cautious approach while awaiting the development of a viable participant spaceflight market. There are, however, positive developments designed to promote operations under existing legislation with appropriate interpretations. An example is Spaceport Sweden, in Kiruna, Sweden. While the Swedish government has no new regulations to allow commercial participant spaceflight, it has an established sounding rocket legislation under which Virgin Galactic hopes to operate suborbital participant spacecraft.³ Another effort concerns the analysis by Marciacq et al. to “*accommodate sub-orbital spaceflights into the European Aviation Safety Agency (EASA) regulatory system, from the perspectives of aircraft certification and operation.*”⁴ The regulations would apply to all European states, and non-European EASA affiliated states, and would be enacted by the national airworthiness authorities.

Spain, the country of interest for this chapter, does not have a national space law or any other specific legislation regulating suborbital spaceflight. Suborbital spaceflight operators wishing to operate there would thus be assuming a higher business risk due to the legal uncertainty surrounding their activities. The purpose of this chapter is to identify the best legal approach through which to obtain regulatory approval to operate commercial human suborbital spaceflights from Spain, with a case study based on the Saragossa airport. This narrow scope will provide concrete recommendations, although the analysis and conclusions will generally apply to the entire nation with adaptations specific to the different regional autonomous communities.

The choice of Saragossa has been influenced by the fact that Saragossa has a sufficiently long runway to accommodate proposed suborbital vehicles, and is currently a Space Shuttle Transoceanic Abort Landing (TAL) site. It has also been chosen due to its proximity to the airport of Lleida-Alguaire, an alternative spaceport location, which was used as a case study by students attending the International Space University's Space Studies Program in Barcelona in summer 2008.⁵ Spain has been chosen more globally as a departure point for space tourism due to its favorable Mediterranean weather, low density population in the arid interior, and its ranking as the 3rd country in the world for tourism.⁶

Technical Scope

It is important to stress that this chapter only addresses suborbital, and not orbital, spaceflight. Although suborbital spaceflights reach an extremely high altitude, only a small portion of the flight path enters the realm of outer space. In the ballistic flight phase, vehicles will reach an altitude above 100km, the unofficial boundary of outer space, for 30-90 seconds, or less than 10% of the total flight time. This altitude is much less than the minimum required orbital altitude of 200-300km where a satellite can remain in a stable orbit for an extended duration without significant atmospheric drag, yet higher than the approximately 20-30 km maximum operating altitude for high altitude balloons and special purpose aircraft.

As a further limitation of scope, this chapter only deals with those vehicles that depart from, and return to a runway in horizontal, aerodynamically supported flight. This has been chosen in order to enable a legal analysis based upon current aviation law and practice as an alternative to the analysis using space law. This dual analysis is not appropriate for the new generation of human-rated vertical launch and vertical landing vehicles, which remain squarely in the domain of rocketry and have few similarities with aircraft.

In order to clarify the scope, Table 1 on the following page summarizes numerous suborbital vehicle projects to clearly identify which fall within the argument of this chapter. The list emphasizes European initiatives, but is non-exhaustive and does not attempt to predict those which will be commercially and technically successful.

Saragossa Airport as a Spaceport

Saragossa Airport is a commercial and military airport located on the northwestern outskirts of the city of Saragossa. The airport has a space legacy since its selection as a Space Shuttle TAL site, but the link to the space industry will likely be severed with the planned retirement of the Space Shuttle in 2011. Thus the opportunity presented by commercial human spaceflight should be seriously considered as a means to preserve and further develop the presence of the space industry in Aragón.

There are several issues that any spaceport must successfully manage in order to receive approval before use as a base of operations for spaceflights. These include but are not limited to:

1. Runway length
2. Noise
3. Propellant handling
4. Flight corridor
5. Air traffic integration

Suborbital Vehicle	Company	Country	Architecture (see note below)	Within Scope
Six-Pack (Fishbowl Cabin)	Armadillo Aerospace	United States	Single-Stage, Vertical Launch & Rocket Landing	No
VSH	Astronaut Club Européen	France	Two-Stage, Air Launch & Jet Landing	Yes
New Shepard	Blue Origin	United States	Single-Stage, Vertical Launch & Rocket Landing	No
Ascender	Bristol Spaceplanes	United Kingdom	Single-Stage Bi-Modal, Horizontal Take-Off & Jet Landing	Yes
TBN	EADS Astrium	France / Germany	Single-Stage Bi-Modal, Horizontal Take-Off & Jet Landing	Yes
Thunderstar	Starchaser Industries	United Kingdom	Two-Stage, Vertical Launch & Parachute Landing	No
Project Enterprise	Talis Enterprise	Switz / Germany	Single-Stage, Horizontal Launch & Glide Landing	Yes
SpaceShipTwo / WhiteKnightTwo	Virgin Galactic / Scaled Composites	United States	Two-Stage, Air Launch & Glide Landing	Yes
Lynx (Mark I & Mark II)	Xcor	United States	Single-Stage, Horizontal Launch & Glide Landing	Yes

Table 1**Suborbital Vehicle Architectures and Scoping for Legal Analysis**

Architecture Note: 'Launch' means under rocket power. 'Take-Off' means under jet engine power.

It is assumed, for the reasons shown below, that these issues are manageable at Saragossa airport even though a thorough technical analysis has not been performed. Further studies, in the context of a potential spaceport license application, will be necessary to mitigate the risk associated with these technical issues.

Runway Length

The Saragossa airport has sufficient infrastructure to permit suborbital spaceflights with minimal additional development. The WhiteKnightTwo, SpaceShipTwo launch stack needs a runway approximately 2600m long for take-off and landing⁷. The Xcor Lynx space plane needs 2400m⁸. The author is unaware of the needs for the other vehicles but assumes that runways of 2500-3000m are sufficient for the majority. Saragossa has two runways, 12R/30L at 3718m long and 12L/30R at 3000m long, permitting take-off and landing from either, which allows additional operational flexibility. The wind conditions have not been evaluated, but could play a role in the selection of Saragossa since the airport does not have a crosswind runway. In the event of adverse wind conditions, the vehicles may not be able to fly on schedule, leading to unsatisfied participants.

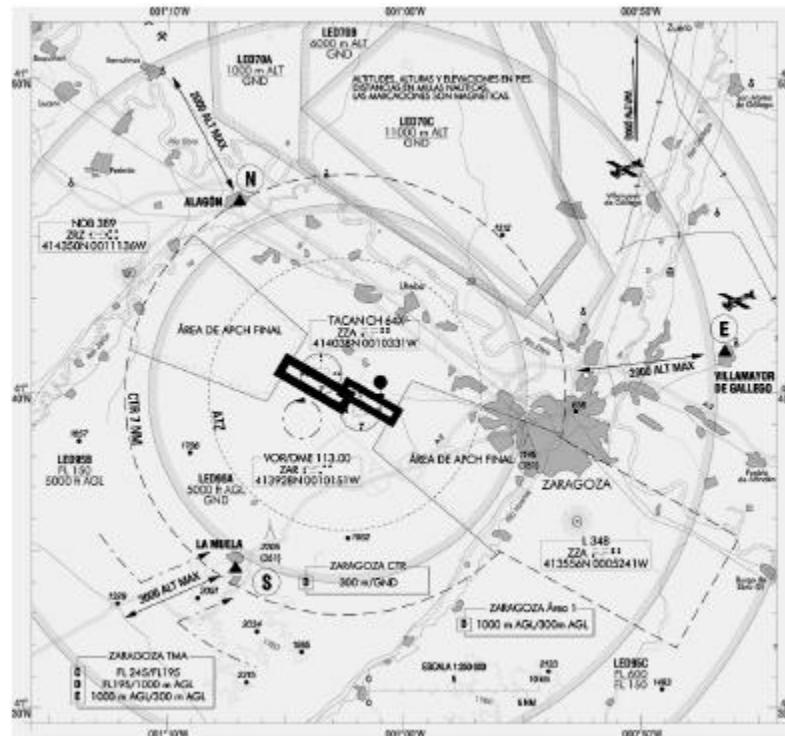


Figure 1

Saragossa Airport Visual Approach Chart (Source: AENA)

Noise

Noise is also of concern, but should be manageable since the airport is home to fighter jets and to large commercial aircraft. The author assumes that rocket vehicle noise will not be more severe than existing commercial and military aircraft movements and will not adversely impact the surrounding population. Noise from launches could generate concern, however, if the flight frequency increases as the market develops.

Propellant Handling

An industrial safety concern includes explosive propellant combinations, and perhaps hazardous or toxic substances, which may be necessary to provide the performance for a space vehicle to reach and maneuver in outer space. Storing these substances is thus necessary within the perimeter of the airport. Appropriate storage and handling procedures must be implemented to limit the consequences in case of an accident. Fortunately, the airport has sufficient terrain and a suitable location is likely to be identified. If the military stores explosive substances, in the form of bombs and other munitions, on-site isolation from the existing depots is also necessary.

Flight Corridor

The FAA has identified flight corridor requirements in the licensing procedures for launch sites⁹ to ensure that the uninvolved public remains safe in the case of a launch accident. Similar provisions will be necessary in Spain. At Saragossa, as illustrated in Figure 1, the area to the northwest of the airport has very little habitation and development. However to the east and southeast there are industrial areas and residential buildings. The spaceport application will need to demonstrate through a compelling risk analysis that there is minimal potential for loss of life in these areas in case of an accident. On the positive side, once away from the city of Saragossa, the population density is low due to the arid environment, and thus the risk of endangering the population is reduced.

Air Traffic Integration

Integration of commercial spaceflights with the existing air traffic will depend greatly on the type of vehicle. Air launched or bi-modal vehicles will operate as traditional aircraft until they achieve an altitude above commercial air traffic. Vehicles launched from the ground however will have a much greater climb rate and will need the equivalent of a vertical corridor to safely pass. An analysis by Marciacq et al. supports the feasibility of integration when it states that *“the basic procedures to cater for special needs (e.g., air shows, large military exercises, climb of weather observation balloons, etc.) are already in place today and could easily be adapted to the needs of [sub-orbital aeroplanes].”*^{10,}

Assuming these technical issues could be resolved, the economic development potential of a spaceport is significant. Business plans and economic impact reports exist for Spaceport America, in New Mexico, and Spaceport Florida which show that commercial spaceflight could have a very positive impact on the local economy.^{36, 37}

The key reasons are impact on local employment and value added activities created by the necessary investments. It must be noted though, that they tend to focus more on potential benefits at large, stopping short of developing a more balanced cost-benefit analysis that would also consider

assessment of risks and other ‘hidden costs’ inherent in such type of investments, or opportunity costs. A similar analysis would be necessary for Saragossa to identify the drivers, comparative economic potential, and also assess the strategic competitive environment and its implications on the results.

Legal Context

A very complete analysis of the legal environment in Europe, with an aviation law viewpoint, is presented by Marciacq et. al.⁴ with an emphasis on demonstrating the EASA competence for regulation of sub-orbital aeroplanes. This paper is recommended reading to better understand the legal issues surrounding suborbital spaceflight and to fully grasp the various arguments and rationales presented herein. Marciacq et al. are also well aware of the legal limitations of the approach, as they clearly identify that EASA does not have competence for the portion of the activity occurring in outer space.

Another thorough discussion, this time from a space law viewpoint, is presented by Sánchez Aranzamendi², a Resident Fellow at the European Space Policy Institute evaluates the national space legislation in European and other countries, and explores the impact of this legislation on the commercial space sector and makes policy recommendations for Europe.

The challenge lies in determining which legal framework, or multiple frameworks, applies, since suborbital flights operate in both the aviation and space environments. There are two schools of thought on this issue: spatial and functional. In the spatial approach, a suborbital flight remains an aviation activity until it passes the boundary from the atmosphere into space. Since this boundary is not absolutely defined, either technically or legally, the spatial approach does not definitively resolve the problem. Practically, the spatial approach would oblige an operator to conform to both aviation and space regulations, which could double the regulatory burden.

The functional approach qualifies the activity based upon the vehicle purpose or capability. The purpose of suborbital vehicles is clearly to give the participant a space experience by entering outer space, thus leading to the likely conclusion that it is a space activity. The U.S. has used the functional approach by providing a clear definition of the vehicles regulated by the AST based upon performance criteria. According to the AST, “*Suborbital rocket means a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent.*”¹¹ This definition simplifies the issue by ensuring there is only one set of applicable regulations independent of the flight phase or altitude.

Spain, due to the lack of relevant legislation and with no historical precedence, has yet to confront the issue.

Arguments for Spanish Competence

Although a pan-European approach would be preferred, as it would allow operators a consistent regulatory environment in all European Union Member States, arguments are presented in this section to demonstrate Spanish competence to regulate suborbital spaceflights.

According to the text of the European regulation establishing EASA, *“It would not be appropriate to subject all aircraft to common rules, in particular aircraft that are of simple design or operate mainly on a local basis, and those that are home-built or particularly rare or only exist in a small number; such aircraft should therefore remain under the regulatory control of the Member States, without any obligation under this Regulation on other Member States to recognize such national arrangements”*¹². With clear guidelines for aircraft that “operate mainly on a local basis,” are ‘particularly rare,’ or ‘only exist in small number,’ we see that all three conditions will be met by suborbital airplanes until such time as the industry has grown to the point of providing point-to-point suborbital flights, or until demand rises dramatically to justify production of fleets of multiple spacecraft by any one manufacturer. Thus from an aviation perspective, Spanish airworthiness authorities are the competent regulatory body for the immediate future.

If we approach the issue from a space law perspective, one needs to consider international obligations. The Outer Space Treaty¹⁴ requires signatory states, including Spain, to provide national supervision of their space activities, which also justifies the argument of national sovereignty for regulating space activities.

Regarding international law, one must also review the treaties delegating powers to the supranational European Union. In reviewing the Treaty on the Functioning of the European Union³⁴, nowhere does it appear that the competence for suborbital spaceflight should be delegated to Europe; thus it must remain with the member state. Some may argue that the European Union and the Member States share the competence for commercial spaceflight. But, according to Sánchez Aranzamendi, Article 189 of the TFEU *“seems to exclude even the widest interpretation of the concept of harmonization,”*² thus leaving little doubt that Spain is competent to legislate on the matter.

In view of the above arguments, it is suggested that Spain clearly holds competence to regulate suborbital flight operations regardless of whether it is considered an aviation or space activity.

Spanish Regulatory Regimes

Having determined that Spain is sufficiently competent to supervise suborbital spaceflight, we will now consider three possible means that it could pursue for regulating commercial spaceflight.

1. Implementation of a new national commercial space law specifically addressing suborbital rocket vehicles and assigning regulatory competence to a Spanish agency.
2. Establishment of a space cooperation treaty with the U.S. to operate under FAA regulations when controlled and operated by an American citizen or entity
3. Operation under existing aviation law with special conditions and equivalent safety findings, similar to the EASA approach, but addressed only at the national level.

1. New National Commercial Space Law

A new national law is sufficient to regulate commercial spaceflights and to provide a clear definition for this activity. This law could be modeled upon another country's law, or could be created anew by considering the key aspects and interests of the Spanish air and space industries.

Key reasons for implementing a national space law, according to Riemann,¹³ are to:

1. Meet international obligations for supervision of space activities under the Outer Space Treaty¹⁴ Article VI.
2. Manage the risk of international liability under the Liability Convention.¹⁵
3. Ensure registration of space objects in accordance with the Registration Convention.¹⁶
4. Promote safety, and
5. Promote commercial development.

In order to reduce risk for suborbital operators, the Spanish government must clarify which ministry is competent to provide the approval and oversight. Obligations under the OST could be met through the need of a suborbital operator to apply for flight approval through the appropriate branch under the Ministry of Transport (Fomento), the Ministry of Defense, or the Ministry of Foreign Affairs and Cooperation. A yet to be defined application process plus a flight plan filing would provide the appropriate opportunity for the required national supervision.

Although suborbital spaceflights will initially occur only within or above the sovereign territory of Spain, foreign registered aircraft also transit its territory, so any aerial collision between a Spanish suborbital spacecraft and a foreign aircraft might give rise to the objective liability regime under the Liability Convention. The government of Spain needs to

frame how they will share the liability with private operators in the case of such an accident. This is done in other nations, such as the U.S. and France,¹⁷ by requiring a minimum level of third party liability insurance coverage, with the State assuming the responsibility above a certain limit. Spanish national responsibilities under the Registration Convention are already covered by Royal Decree 279/1995,¹⁸ which establishes the Spanish Registry of Objects Launched into Outer Space. This will be useful to govern future space activities with orbital applications, but is not necessary for suborbital flights.¹⁹

Finally, it is in the interest of the Spanish government to promote safety of third parties within the Spanish territory, and to promote the commercial development of the industry. Both of these objectives can be assured by delegating the competence for regulation to a state agency. This would likely be the State Agency for Aviation Security (AESA) but could also include, to various degrees, input or oversight from the General Directorate for Civil Aviation (DGAC), the Spanish Airports and Air Navigation (AENA) and the National Institute for Aerospace Technology (INTA).

Two means are likely to be used to propose a new Spanish national law.²⁰ The first is via a bill prepared by the government, approved by the council of ministers and submitted to the congress and senate for approval. This method would likely be used if an operator interested in launching from Spain contacted the Ministry of Transport. The second method is via the legislative assembly of an autonomous community sending a request to the national government to adopt a bill, or by sending to the Board of Congress a proposal of law. The government of Aragón could pursue this second method in the event that they decided to promote commercial spaceflights from Saragossa as a strategic economic interest to the region.

2. Space Cooperation Treaty between Spain and the United States

An innovative way to manage the regulation of commercial suborbital spaceflights would be to utilize the existing FAA framework and extend this framework via treaty to apply to operations from Spain. This learn-as-you-go approach would give Spain the necessary legal framework to immediately benefit from the commercial development potential while instituting the necessary regulations and laws. The DGAC would likely have final approval for any FAA issued launch license, which would presumably apply only to operations under the control of a U.S. citizen. This arrangement would allow Virgin Galactic and other U.S. operators to fly from Saragossa under familiar regulations.

A provision in U.S. national law²¹ requires U.S. citizens to apply for a launch license in a foreign state and also requires foreign entities in which a U.S. citizen has a controlling interest to apply for an FAA launch license.

A “controlling interest means ownership of an amount of equity in such entity sufficient to direct management of the entity or to void transactions entered into by management.”²² Hence, the two conditions for operating from Saragossa under U.S. law are:

1. Existence of a treaty in force between the U.S. and Spain covering commercial spaceflight, and
2. Operation of commercial spaceflights by an American controlled entity.

The challenging aspect of this approach is to find an existing treaty or to negotiate a new treaty that will specifically cover commercial spaceflights. There are several existing space cooperation treaties in force. The Agreement on Space Cooperation signed at Madrid on 11 July 1991 and entered into force on 9 May 1994²³ concerns landing of the Space Shuttle in the event of a TAL event at the air bases of Moron, Rota, or Saragossa and at the airport of Las Palmas de Gran Canaria. This treaty, however, is not suited to supervise commercial spaceflight, as article 1 of the treaty clearly limits it to emergency situations.

The remaining provisions of this treaty could potentially be used because the term ‘space shuttle’ refers to any manned space vehicle as defined in the text. In the event that both U.S. and Spanish authorities wanted to cooperate on a suborbital spaceflight demonstration and were willing to overlook the non-emergency nature of the spaceflights, the notification procedure could be used to implement the remaining provisions of the treaty. This demonstration would have to be under the responsibility of the U.S. government in order to comply with the terms of the agreement. An operator fulfilling a research contract to perform high altitude atmospheric or microgravity studies would be an example, but again, this arrangement would be overly burdensome for regular commercial spaceflights.

The other treaty in force, Memorandum of Understanding between the Instituto Nacional de Técnica Aeroespacial (Representing the Comisión Nacional de Investigación del Espacio) and the U.S. National Aeronautics and Space Administration, entered into force 14 April 1966²⁴ concerns launching of sounding rockets for high altitude experiments. At first glance, this treaty could cover a demonstration flight, potentially within the framework of NASA’s Commercial Reusable Suborbital Research program, since there is a provision for joint experiments using “*additional equipment as may be necessary in each case,*” but only for scientific purposes as stated in the treaty and here again under the supervision of NASA and INTA.

From a civil aviation perspective, the Nat-I-1363 Memorandum of Agreement between The United States of America Department of Transportation Federal Aviation Administration and the Government of

Spain Ministry of Transport, Tourism and Communications Subsecretariat of Civil Aviation, entered into force 22 July 1982²⁵ could be a starting point for a further agreement for collaboration on commercial space transportation. Article VI of this treaty provides for an amendment procedure “*to provide for expansion of requirements and continuation of the program.*” It would thus suffice for the DGAC to negotiate with the FAA for an annex expanding the scope to include commercial space transportation and then having both States ratify the annex as a new treaty document.

Based upon the authors’ understanding of the competence granted to the DGAC²⁶, this organization has the authority to negotiate a treaty with the FAA (or other foreign aviation authorities) to promote cooperation related to civil aviation, which would of course require approval in accordance with the process defined in the Spanish constitution²⁷ and as practiced by the U.S. government²⁸. It is unclear under which process this treaty would be approved by Spain, as it could be by:

1. Organic law;
2. Parliamentary authorization; or
3. Signature by the government.

In the U.S., the treaty could enter into force after executive agreement or senate approval. If the need were recognized to elaborate a comprehensive treaty arrangement, Spain and the U.S. should build on the past tradition of aviation and space cooperation. The major changes in space cooperation to enable commercial spaceflight would entail a change in implementing agencies. While current agreements are primarily between NASA and INTA, future commercial space agreements will probably involve the FAA and the DGAC. This change in implementing agency is an additional reason that existing space cooperation treaties are not likely to work from a practical standpoint.

3. Existing Aviation Law with Special Conditions and Equivalent Safety Findings

The final method to examine for governing commercial human spaceflight is to utilize the existing regulatory framework for aviation activities. As there is no internationally binding altitude limit for the boundary between sovereign air space and the domain of outer space, one could argue that space tourism occurs within the sovereign airspace of a State. The popularly accepted value for this boundary at or around 100km has no value in customary international law and is thus not enforceable. Spain could reasonably claim sovereignty of its airspace up to an altitude of approximately 120-200km, or make a domestic legal distinction for aviation activities, without extending its airspace to the lowest orbits currently in use. Australia, in 2002, made a practical clarification to

separate air and space activities by amending its domestic space law to apply to space activities that occur above 100km altitude, although without intending to set an international standard for this boundary.²⁹

Qualifying the anticipated suborbital flight altitudes as sovereign airspace would thus allow application of aviation law and regulations. Since aviation activities are currently regulated by the AESA and the DGAC, these would be the appropriate organizations to approach for licensing approval. In order to qualify under the existing technical requirements, special conditions and equivalent safety findings would need to be granted by the national authority in the same way as described by Marciacq et al. for EASA approval.³⁰

Should the DGAC or the AESA wish to further solidify their jurisdiction over commercial spaceflights, the government could issue new law through regulation (reglamento),²⁷ which could take the form of a decree (decreto) by the Council of Ministers, an order (orden) by the Minister of Transport, or an instruction (instruccion) or an order of regulation (circular) from the DGAC or the AESA. This action would be a regulatory rather than a legislative action.

Additional Legal Issues for Consideration

There are additional legal issues for a commercial spaceflight operator to consider that go beyond the scope of a simple licensing authorization. These include but are not limited to regional, national and supranational laws impacting participant liability, third party liability, contract law, advertising law, insurance law, environment law, private law, competition law, and consumer law.

In Spain, there are up to four competent jurisdictions regulating a space tourism operator. These are the municipality, the autonomous region, the State (Spain) and Europe. Each of these levels has competence in some aspect of the space tourism operation.

Spain is based upon a federal system with the autonomous regions keeping legal competence for many government affairs. The national level will only be responsible for the issues such as air and space law, while the autonomous regions will be responsible for tourism, contract and liability issues, and municipalities may be responsible for local issues.

An example of an additional legal issue at the national level is spaceport licensing. While this chapter has investigated licensing of a launch operator, the airport of Saragossa will most certainly also need to obtain an authorization to operate as a spaceport. This of course depends upon the legal regime under which space tourism activities fall. If it remains under the existing aviation law, then a simple extension may be all that is necessary to allow operation of rocket powered vehicles from the airport. If the treaty option is retained, then the airport will need to file for

a spaceport license with the FAA, but this may only be allowed if the spaceport itself is under the control of an American citizen or entity, which is not the case in Saragossa. Thus a treaty might leave the spaceport licensing in limbo, which could prevent an operator from obtaining a permit or license. The creation of a privately operated air and spaceport could be envisaged under the current Spanish laws and could lead to spaceport licensing approval under the treaty if this facility is majority owned by American interests. The private airport of Ciudad Real was developed through private investments, and a private spaceport could also be envisaged.

Since the autonomous communities retain competence for most legal issues, they will be heavily involved in approving the legislation that will encourage development of this industry. This is directly comparable to the actions by states such as Virginia and Florida in the U.S. that limit participant liability and provide tax exemptions through 'zero-g, zero tax' laws. Virginia³¹ exempts *"any gain recognized from the sale of launch services to spaceflight participants ... or launch services intended to provide individuals the training or experience of a launch, without performing an actual launch."*

Concerning participant liability, Virginia enacted the Space Flight Liability and Immunity Act,³² to provide a clear and legally binding informed consent statement for participants. Both actions provide direct financial incentives to operate from Virginia by reducing the business risk assumed by a spaceflight operator. The autonomous region of Aragón could encourage spaceflight operators to operate from Saragossa by passing similar legislation. Other initiatives such as spaceport development subsidies and local tax districts for infrastructure improvements would go a long ways towards convincing operators to expand in or relocate to Saragossa.

Finally, some European laws would also apply. One example of this is the EC Package Holidays Council Directive 90/314/EEC as discussed by O'Brien.³³ In this case a space tourism operator could be subject to additional regulations if it were considered part of a travel package grouped with transportation, accommodation or other tourist services. Contractual agreements with the package organizer or appropriate corporate structuring could limit the responsibility of the spaceflight operator.

Methodology for Evaluating the Legal Strategies

At the outset of the research for this chapter, the authors were unfamiliar with the applicable Spanish and international laws, and the chosen research approach was to conduct a series of semi-structured interviews with experts familiar with the legal and political environment in Spain and knowledgeable in the fields of space law and aviation law.

Interviews were conducted via a two step process. First contact was made by email for five of the seven interviewees, and followed up with a telephone interview. The other two interviewees were introduced to the questions and interviewed in person. One interview did not sufficiently address any of the prepared questions and thus has been eliminated from analysis.

The choice of a semi-structured interview process was to enable investigation of the specific questions while allowing the discussion to expand into other areas relevant to the subject of space tourism in Spain.

Analysis and Synthesis of the Interviewee Responses

The combination of interviews and literature research has made it possible to reach qualitative recommendations, but naturally it has not yielded any absolute legal strategies for obtaining authorization to conduct suborbital spaceflights from Saragossa airport. Table 2 shows the perceived strengths and weaknesses of each approach, followed by a summary that proposes a final recommendation.

EASA

Although the EASA framework was not specifically addressed during the interviews, the author felt it was essential to evaluate this approach. Oversight of commercial spaceflight by EASA would be an appropriate strategy, but first the activity would need to be legally defined as an aviation activity rather than a space activity, and included in the competence transferred to Europe. Since this classification is not yet resolved, it cannot be certain that EASA has competence, and further clarification of EASA's role, mandate and involvement will need to be provided within the framework of this newly emerging industry.

New National Law

A new national Spanish law specifically addressing the issue of human commercial spaceflight is a guaranteed method for adequately regulating the activity. Passage of a new national space law through the Spanish parliament would be sufficient to govern the activity, although the process might be time-consuming and could distract from the immediate issue, which is for an operator to be granted a launch license.

Treaty with the U.S.

Establishment of a treaty with the U.S. was a very controversial subject during the interviews. The treaty process is seen as an imperialistic approach due to the envisioned application of FAA regulations on Spanish territory. The treaty would need to be negotiated under the supervision of the Ministry of Foreign Affairs and Cooperation and would directly involve the DGAC and the FAA, and its practicality depends directly on the quality of the relationship between the U.S. and Spain and on their willingness to work together. The lead time for this approach depends upon the process used for ratification, as approval through the legislative branches would be longer than an expedited executive agreement.

Existing Aviation Law

The use of existing aviation law is the most likely and most direct approach to obtaining launch authorization. The competence for this activity rests with the Ministry of Transport and is exercised by the DGAC and AESA. AENA should also be considered as a service provider due to its management of the Saragossa airport. INTA may have some competence since suborbital flights are also a space activity. Even if it were possible to initiate the activity under existing aviation law, additional interpretations, rules and regulations would need to be created.

Synthesis

A clear result from the literature review and the interviews is that the DGAC should be the first organization approached to request regulatory action to support suborbital spaceflight launch authorizations. In addition to having relevant, though not comprehensive competences, the organization also has the authority to create additional regulations to supervise and manage suborbital flight operations. The DGAC will be able to coordinate internationally with the EASA and the FAA, and domestically with the AESA, the INTA and other Spanish Ministries to identify the most appropriate of the four alternative approaches to follow, or create a new approach.

A few key points about the political situation have also been noted. Firstly, political support will require demonstration of a clear economic interest in developing commercial spaceflight in Spain. As with the spaceports in the U.S., an economic impact statement and business plan will need to be created for the spaceport authority based in Saragossa, which must show that investments by the government will deliver a return in the form of local employment and future tax revenues.

The autonomous regional governments will need to show proactive efforts in order to attract operators. In addition to supporting the national regulatory activities through their political network, they will need to enact regional laws. This means passing legislation providing financial incentives to commercial operators to reduce liability and taxes, and

codifying informed consent laws to specify what it means to be informed so that any operator would be less likely to be unfairly pursued, in case of an accident, by a participant who had previously agreed to assume the inherent risk involved in spaceflight. Additional investments in spaceport infrastructure at a regional level will also be needed to reduce the startup costs for an operator.

As the industry expands and commercial activity develops, a Spanish national law will be required to clarify the competence and to structure the legal environment. This law will clearly define who is responsible for approving flights within the Spanish government and how the responsibilities overlap with EASA, FAA or within the national ministries. This law is also necessary to address the issue of a combined air and space activity. Further reflection will be required to determine the most appropriate means of implementing the national law whether it comes from a rule-making effort within the Ministry of Transport or from a legislative effort.

EASA [European Aviation Safety Agency]	
<i>Strengths</i>	<i>Weaknesses</i>
<ul style="list-style-type: none"> <input type="checkbox"/> Provides clear legal basis for certification and operations of winged suborbital vehicles <input type="checkbox"/> Pan-European approach will facilitate expansion to other European States <input type="checkbox"/> Certification demonstrates compliance to necessary safety standards thereby reassuring participants and public <input type="checkbox"/> National aviation authorities could provide national supervision to comply with space treaty obligation 	<ul style="list-style-type: none"> <input type="checkbox"/> Type certification may be costly and time consuming for vehicle manufacturers <input type="checkbox"/> Excludes vertical launch and vertical landing vehicles from the regulatory framework <input type="checkbox"/> Lack of defined liability sharing between operator, EASA and the State
New Spanish National Law	
<i>Strengths</i>	<i>Weaknesses</i>
<ul style="list-style-type: none"> <input type="checkbox"/> Clear legal basis for operations of any suborbital vehicle <input type="checkbox"/> Identification of national authority for approval of operations in outer space <input type="checkbox"/> Clarification of liability sharing between operator and State 	<ul style="list-style-type: none"> <input type="checkbox"/> Time consuming legislative process may slow development of industry <input type="checkbox"/> Legislative process opens the discussion to a larger audience of interested individuals which may oppose the specific needs of suborbital operators

Table 2

Comparison of Legal Approaches to Obtain Suborbital Spaceflight Launch Authorization

Treaty with the U.S.	
<i>Strengths</i>	<i>Weaknesses</i>
<ul style="list-style-type: none"> <input type="checkbox"/> Existing FAA regulations can be utilized for timely licensing approval <input type="checkbox"/> Familiarity of launch operators with licensing procedure will reduce risk and lower cost of entry into new market <input type="checkbox"/> Potential extension to existing space and aviation cooperation treaties <input type="checkbox"/> Can be negotiated directly between the DGAC (Dirección General de Aviación Civil (General Directorate for Civil Aviation)) and the FAA 	<ul style="list-style-type: none"> <input type="checkbox"/> May apply only to U.S. controlled operators <input type="checkbox"/> Unlikely to be able to use an existing treaty as the sole legal basis <input type="checkbox"/> Ratification of treaties can occur several years after the signature of the treaty <input type="checkbox"/> Spaceport licensing might not be provided for in agreement

Existing Aviation Law	
<i>Strengths</i>	<i>Weaknesses</i>
<ul style="list-style-type: none"> <input type="checkbox"/> No legislative changes required to the existing law <input type="checkbox"/> AESA, DGAC and Ministry of Transport can rely on existing aviation experience <input type="checkbox"/> Most rapid approach to spur commercial development of the industry 	<ul style="list-style-type: none"> <input type="checkbox"/> Incomplete regulation burdens operator with additional risk <input type="checkbox"/> DGAC/AESA may decide they are not the competent authority <input type="checkbox"/> New interpretations and regulations to be created by the DGAC/AESA

Table 2, Continued

Comparison of Legal Approaches to Obtain Suborbital Spaceflight Launch Authorization

Conclusions and Recommendations

There is certainly a need to structure the legal framework in Spain to permit suborbital spaceflight, but the alternatives for achieving that objective examined here show promise that a solution can be readily found. The current legal environment provides a starting point for further law making and regulation. Aviation law is well developed in Spain and can be extended through both executive and legislative action to provide a robust and straightforward process that permits licensing of commercial spaceflight operators while ensuring the safety of the public and participants.

Identification of the competent authority, most likely the DGAC, is the first step that is necessary to begin driving forward the discussion

within the Spanish government. The authority must conduct an investigative dialog with the national, European and international counterparts in order to make an informed decision on the approach that will ensure success of the commercial spaceflight industry during the initial development but also during future expansion towards point-to-point suborbital travel or orbital transportation.

In order to bring space tourism to the airport of Saragossa, several further studies will need to be conducted. Most importantly, a thorough economic evaluation must be prepared to determine whether potential investments in infrastructure are justified. The study should identify benefits from participant spending, tourist visits to witness the spaceflights, high technology employment and any additional economic activity in support of the industry. A technical feasibility study will also be necessary. This study should evaluate whether concerns such as the safety, air traffic integration, environmental, noise and infrastructure can be satisfactorily resolved at the airport. If not, an alternative location would need to be found using an existing runway or by constructing a dedicated facility.

Spanish legal experts should conduct further research to expand upon the law making approaches presented herein. Familiarity with aviation and space law will be crucial to investigate the subtleties of the existing law and to construct a legal approach that considers the political environment. It is recommended that the DGAC should lead this further research so that the conclusions can be acted upon within the directorate.

Finally, political support by local and regional politicians should not be underestimated. The regions where spaceports are created will be the ones to benefit most from the resulting prestige and economic development. These politicians will be able to use their existing networks to bring enthusiastic and visionary leaders to such a challenging project ensuring success at all levels of government. At Saragossa airport, Aragón has a vested interest in keeping a link to the space industry once the Space Shuttle is retired. The opportunity of commercial spaceflight should be actively pursued to maintain and further develop this connection to outer space.

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Note: This chapter is based largely on Garrett Smith's prior unpublished work, under the guidance of Dr. Vasilis Zervos, in the context of the Masters of Science in Space Management program, Class of 2009, at the International Space University, Strasbourg, France. Both authors have further contributed to improve upon the original work.

Abbreviations and Acronyms

AENA	Aeropuertos Españoles y Navegación Aérea (Spanish Airports and Air Navigation)
AESA	Agencia Estatal de Seguridad Aérea (State Agency for Aviation Security)
AST	Associate Administrator for Commercial Space Transportation, Office of Commercial Space Transportation, Federal Aviation Administration
COPUOS	United Nations Committee On Peaceful Uses of Outer Space
COTS	Commercial Orbital Transportation System
DGAC	Dirección General de Aviación Civil (General Directorate for Civil Aviation)
EADS	European Aeronautic Defense and Space Company
EASA	European Aviation Safety Agency
ECSL	European Center for Space Law
ESA	European Space Agency
FAA	Federal Aviation Administration
INTA	Instituto Nacional de Técnica Aeroespacial (National Institute for Aerospace Technology)
ISU	International Space University
NASA	National Aeronautics and Space Administration
OST	Outer Space Treaty
TAL	Transoceanic Abort Landing (site for NASA's Space Shuttle during emergency conditions)
TBN	Temporary name for EADS suborbital space tourism project
TFEU	Treaty on the Functioning of the European Union
VSH	Véhicule Suborbital Habité (Human Suborbital Vehicle proposed by the European Astronaut Club)

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