Commercial satellite programs

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Introduction

The commercial satellite industry has changed dramatically over the past 20 years from mainly involving telecommunications satellites (fixed point voice, data, and services), and direct broadcast television and radio satellites to an industry that now also includes: mobile services, machine-to-machine communication networks, asset tracking systems, private networks, hosted payloads and “condosats”, and private remote sensing systems that have real-time capabilities. In the near-term horizon there are also likely to be other new emerging technologies and services, such as private weather satellites and satellites that can perform on-orbit activities such as refueling, repairing and servicing other satellites. In addition, there has been a rapid development of privately financed small satellite systems with a large numbers of satellites that can operate independently and/or synchronize their systems and services.

A number of these and other technologies will likely enter the commercial realm fairly quickly since many evolve from the R&D and operational programs already incorporated into existing government space systems. There are other past examples of this evolution, but it still should be noted that commercial operations are different from government R&D or mission spacecraft and do require significant innovations, cost-saving technologies, and market development. Commercial operations ultimately need to be predicated on market demand and a demonstrated business case. Hosted payloads, joint procurements and multi-satellite constellations also introduce new sets of complexities. Each of these new technological capabilities will require attentiveness to specialized risks and interdependencies in the contractual arrangements between manufacturers and satellite operators, satellite operators and customers, satellite operators and lenders, as well as in governmental licensing procedures.

Understanding the commercial and legal risks associated with commercial satellite programs has become increasingly important in this developing area of the law. Financing of such programs and understanding the interdependencies of and related risks among the underlying arrangements between satellite operators and their key counterparties in a satellite program is critical, and the mitigation of such risks must ultimately impact the arrangements between satellite operators and their lenders or investors.
Some of the future legal challenges in contracting for commercial satellite programs are predictable, but many will depend on market developments, consumer demands, emerging business models, sources of financing, and other factors. Those other factors may even include non-space substitutes and complements to existing services. Such systems could be, for example, commercially developed high-altitude platforms that would provide regional communications and Earth observation services similar to those performed by satellites but located within altitudes legally under the jurisdiction of an existing government. Other services could be a combination of terrestrial equipment interacting with instruments on airplanes, sub-orbital rockets, and future reusable hypersonic transport vehicles. Although this may sound more like science fiction, enabling technologies for all of these types of systems are in the research and development stages today.

The legal and procurement issues can differ greatly among the various types of satellites and services offered, as well as the type of financing used. In the context of a single satellite program, the entity that undertakes to contract for the manufacture, launch, operation and financing of a satellite, ultimately serving as the satellite operator, will take on many roles in relation to its counterparties. It will be a purchaser under its satellite manufacturing contract, a customer under its launch services contract and Telemetry, Tracking and Command ("TT&C") contract (if it is not flying the spacecraft itself), a borrower under its loan documentation or an investment vehicle to its investors, and a service provider to its customers, and perhaps a partner to another satellite operator in the context of a hosted payload and/or condosat. This chapter will, at a high level, introduce the basic contractual issues involved with the procurement and financing of commercial satellite programs and highlight recent examples of programs that illustrate the importance of select concepts described. The focus will be on introducing these concepts in the context of a geosynchronous telecommunications satellite program undertaken by a single satellite operator, but we will also introduce certain significant differences among the newer services being offered. Given the complexity of the contracts and the legal issues involved, a full treatment is not possible here on the breadth of issues or the intricacies associated with negotiating each. Instead, we will focus on certain areas that have become more visible in the current commercial space environment.

The commercial satellite industry

The commercial satellite industry has more than doubled over the past ten years and, while there have been some dips in revenue along the way, it continues to be resilient and show robust economic growth in revenues.¹ Today, on a worldwide basis, annual revenues from all satellite services total more than $200 billion. This total includes manufacturing, launch, broadcast and other private sector sales. Over 40 percent of those sales are U.S. based. However, the largest annual growth rate is in non-U.S. sales. The largest component of the revenues is in direct broadcast television/direct to home, which accounts for 77 percent ($97.8 billion) of all satellite services revenue. Although the relationship between fixed and mobile satellite services is increasingly becoming intermixed and complex, each grew at 4 percent annually. Interestingly, there was also a noticeable and significant increase in the rate of growth of Earth observation services of 10 percent between 2014 and 2015, representing a new trend in private sector interest as well as governmental interest in developing new Earth observation applications.

¹ These, as well as the subsequent figures, are taken from: Satellite Industry Association State of the Satellite Industry Report, September 2016.
Of the nearly 1,400 operating satellites in space, about 38 percent are for commercial communications, 14 percent for Earth observation and the rest divided among government satellites used for many purposes ranging from communications to navigation, research and exploration. Additionally, even government-sponsored programs often involve contracting with private satellite manufacturers and launch services providers, and they have been financed by sources other than by the host government, and so they too are operating in a satellite manufacturing ecosystem that largely features commercial actors.

Also of note is the re-emergence of the idea of satellite constellations and the rapid growth of very small satellites from private companies. The number of these satellites launched rose from a handful in 2012 and preceding years to about 100 in 2014, indicating a new and very interesting future trend in this industry. Most of those satellites were designed for Earth observation and are still in the research and development stage, having not yet advanced to a robust commercial market.

Additionally, the advent of the next push in both government and commercial space technology is beginning to become apparent with the growth of proposals to perform new types of operations in space. Companies are developing the ability to refuel, repair, and service satellites in space. These abilities range from the ability to approach satellites and observe their functioning (or non-functioning in the case of satellites needing repairs), to docking with space assets to refuel, repair, move, or otherwise change their location, operations, or functioning. At the same time, the financing of satellite programs has also continued to evolve. For example, in recent years, export credit agency financing has played an increasingly important role.

What are the key commercial and legal risks associated with commercial satellite programs and the financing of such programs, and how can satellite operators mitigate those risks to make their programs more attractive to investors and lenders? How should lenders diligence such programs? How do lenders and investors view these programs differently from other infrastructure projects? This chapter introduces some of the most salient issues and introduces some of the critical considerations, viewed through the lens of a satellite operator/borrower and lender or investor in a commercial satellite program. There are certainly many other considerations, and solutions are necessarily program specific and must be understood and considered in the context of the individualized satellite program.

**Procurement of satellite programs and the key associated contracts**

A procurement of a new commercial satellite involving a single geosynchronous satellite must begin about three to five years in advance of the planned launch of the satellite. The usually key drivers of timing include: (1) the two to three year manufacturing period for a satellite using mostly existing technology, as well as (2) establishing a window for launch on the manifest of one of the launch services providers. For a new program, the overall key steps include establishing a strong base case model containing the financial projections for the program, gaining access to an orbital slot and associated radio frequency spectrum, negotiating the satellite manufacturing contract, negotiating the launch services contract, negotiating or otherwise provisioning for TT&C, insuring the manufacture, launch and in-orbit functioning of the satellite, executing customer contracts, and identifying the investment or financing source for the program. From the perspective of the satellite operator, the key commercial participants are the satellite manufacturer, the launch services provider, the TT&C provider, the customers, and the investors and/or lenders.

Manufacturing and launch services contracts have to be tailored to address specific program risk issues and considerations, as well as variations arising from programs involving, for example,
multiple payloads, new intellectual property, constellation programs, creative partnerships between satellite operators, technology transfer from a manufacturer to a satellite operator, and many other variations. The ultimate impact on the “bankability” of such programs must be understood by a satellite operator seeking to package manageable risk for the potential lender or investor. Without considering these issues early on, the satellite operator risks having to renegotiate contracts from a much weaker position relative to the bargaining power the satellite operator has early on in negotiations, requesting concessions from its counterparty after all other arrangements have been bargained for and the counterparty is well aware that the requested modification is one upon which the satellite operator’s financing might rely, potentially resulting in the satellite operator having to make concessions that could have been avoided at the outset. Legal practitioners will need to continue to evolve in their approach to drafting these contracts and addressing issues associated with new technology and business models as well as in helping to identify risk mitigants in connection with these. The underlying finance and commercial legal concepts have not changed, but the implementation of these certainly has, and there will be a continued need for creative problem-solving as new issues arise.

Contract for the manufacture of the satellite

The contract for the procurement of the satellite is typically called the “Satellite Purchase Agreement”. The satellite operator is the purchaser under the Satellite Purchase Agreement, and its counterparty for this agreement is the satellite manufacturer. As commercial contracts, these arrangements are subject to the same underlying legal principles and requirements as other commercial contracts, but the specific provisions are highly specialized. Some of the specialized key provisions in a Satellite Purchase Agreement include, at a high level:

- **Scope of work and deliverables**: satellite manufacturer agrees to provide the necessary personnel, material, services and facilities to design, manufacture, test and ship the satellite, along with other deliverable items;
- **Price and payment terms**: specifies timing of payments, which are usually milestone based and may be tailored to parallel costs paid out by the satellite manufacturer in connection with components and long-lead items, since initially most of the activity will be in the design phase and will not require significant outlays of funds to component manufacturers; invoicing mechanism; late fees; treatment of taxes;
- **Launch vehicle compatibility**: satellite manufacturer to maintain compatibility with a set of candidate launch vehicles and down-selection timing of same; satellite manufacturer’s obligation to provide assistance and to communicate and cooperate with the launch services provider to support integration of the satellite with the designated launch vehicle; treatment of launch base support services and costs associated with specific launch vehicles;
- **Delivery of the satellite, acceptance and ground equipment**: satellite operator/purchaser will conduct a review of the satellite prior to shipment or the satellite’s entry into storage, referred to in the industry as the “Satellite Pre-Shipment Review”;
- **Delivery schedule and the ability to make adjustments**: contracts vary in flexibility associated with the parties’ rights to make changes to the delivery schedule, subject to agreement on modification of impacted terms such as price and schedule, among others; a stop work provision may sometimes be included; treatment of excusable delays;
- **Transfer of title and risk of loss** (as modified by type of delivery, i.e. on-ground versus in-orbit): title to and risk of loss or damage to the satellite passes from satellite
manufacturer to satellite operator/purchaser at the time of intentional ignition of the launch vehicle used to launch the satellite; transfer of title of non-satellite deliverable items to occur when such items have been accepted by the satellite operator/purchaser;

- **Orbital performance incentives or a payback scheme in connection with the performance of the satellite:** the satellite manufacturing contract may provide that the purchaser pays to the manufacturer orbital performance incentives after a specified time after in-orbit testing, with the amount adjusted based on the performance of the satellite at such time, or there may be provisions for an incentive payment or payback, of such incentives if the satellite later does not continue to perform to such levels, depending on whether the failure to perform can be attributable to the satellite manufacturer; such orbital performance incentives and warranty payback provisions become part of the overall economic transaction, and satellite operator/purchaser requirement for significant orbital performance incentives or a warranty payback may result in a different negotiated price and other terms;

- **Warranties and limitations of liability:** satellite manufacturer warrants that the satellite will be manufactured and will perform in accordance with agreed specifications at the time of delivery, with warranty terminating at the time of intentional ignition; warranty for ground system customarily extends beyond such time;

- **Authorizations:** responsibility for preparing, coordinating and filing applications, registrations, reports, licenses, permits and authorizations with the applicable regulatory authorities and with any other national governmental agencies having jurisdiction over the satellite operator, for the construction, launch and operation of the satellite; satellite manufacturer support in connection with same; radio frequency coordination; compliance with export control laws;

- **Regime for liquidated damages for late delivery and early delivery incentives:** in the event of a late delivery of the satellite by the satellite manufacturer, the parties agree to a pre-established regime for liquidated damages to be paid by the satellite manufacturer to the satellite operator/purchaser; conversely, the satellite may be delivered before the scheduled delivery date, and such early delivery may result in the satellite operator/purchaser making an agreed incentive payment to the satellite manufacturer;

- **Satellite operator/purchaser right to terminate for convenience:** the satellite operator/purchaser’s right to terminate for convenience will be subject to a scheduled termination liability, based on when in the performance of the contract the termination occurs; if the satellite operator/purchaser has made payment for such work pursuant to such terms, then there may be a provision by which completed work would pass to the satellite operator/purchaser;

- **Termination for satellite manufacturer default:** the satellite operator/purchaser will have a right to terminate the contract if the satellite manufacturer fails to deliver the satellite by the established date of delivery plus an additional period of time; the termination liability will generally be based on amounts paid on the contract to date, with certain carve-outs; there may also be a provision in which the satellite operator could have the option to obtain title to the work-in-process at a negotiated price;

- **Termination for satellite operator/purchaser default:** the satellite manufacturer will have the right to terminate for satellite operator/purchaser failure to pay or for other material breaches; termination liability for satellite operator/purchaser failure may be based on the amounts paid for satellite operator/purchaser’s termination for convenience or may be separately established;
**Indemnity for personal injury and property damage, and waiver of subrogation:** the satellite manufacturer will customarily agree to indemnify the satellite operator/purchaser, affiliates and subcontractors against any losses, damages and other liabilities adjudicated to be owing to a third-party claimant if the losses of such parties were caused by, or resulted from, a negligent act or omission or willful misconduct of the satellite operator or the satellite operator’s employees or representatives; the satellite manufacturer will not assume any liability for third-party loss caused by the satellite after delivery to the satellite operator/purchaser; the satellite operator/purchaser undertakes a parallel indemnity for losses caused by its employees or representatives; certain inter-participant waivers will be required; the parties undertake to obtain a waiver of subrogation and release any right of recovery against the other party and from any insurer providing coverage for the risks subject to indemnification;

**Property insurance:** manufacturer commits to insure the satellite up to delivery to the satellite operator/purchaser, and the satellite operator/purchaser agrees to obtain subrogation waivers from its launch and in-orbit insurers;

**Intellectual property rights:** the satellite manufacturer will generally indemnify the satellite operator/purchaser against third-party claims or suits based on an allegation that the manufacture or use of the satellite or any other deliverable item infringes on any third party’s intellectual property rights; treatment of existing versus created intellectual property, including jointly created intellectual property, if applicable;

**Assignment and security interests:** typically bar against assignment of contract, unless to affiliates with sufficient financial resources to fulfill the assigning party’s obligations; satellite operator/purchaser should be able to assign without the manufacturer’s consent if in connection with obtaining financing for the satellite; there may be other exceptions as well;

**Post-launch anomaly support and corrections:** satellite manufacturer will investigate anomalies during the in-orbit life of the satellite and undertake satellite anomaly resolution support and provide software upgrades as applicable (with price terms negotiated); and

**Mission operations support services:** describes services related to the satellite which continue for the life of the satellite.

The foregoing provisions can be highly negotiated, each in connection with the others, and each program requires its own overall balance based on the commercial imperatives of the purchaser, negotiating leverage of the parties and the underlying economics of the project. For example, a satellite manufacturer may be more willing to provide a shorter production schedule if the liquidated damages scheme is more favorable and adequately scales up over time and there is an otherwise longer long-stop date after which the purchaser's termination rights arise, as well as whether the program is one involving new or existing technology and whether the satellite operator/customer is one with experience in the industry and that will be a known good partner over the multi-year period in which the satellite is constructed.

While there is a great deal of discussion that could be had regarding each one of the provisions in a satellite manufacturing contract, we highlight below two specialized topics related to satellite purchase agreements, focusing on important satellite-specific issues and emerging areas of the law with respect to the commercial satellite industry.

**In-orbit delivery contracts**

A critical differentiator between types of satellite purchase agreements is whether the satellite will be delivered by the manufacturer to the satellite operator at the time of launch or whether
delivery will occur after in-orbit testing of the satellite (an “IOD Contract”). An IOD Contract provides for the manufacture, launch and insuring of the satellite(s) in a single contract between the satellite operator and the satellite manufacturer. A sophisticated purchaser may wish to have control over launch and insurance, rather than having the satellite manufacturer run the launch services and insurance process. A newer or first-time satellite operator, however, may prefer to pay a premium for end-to-end service. And a lender or investor to a satellite operator with an IOD Contract may be willing to relax covenants or equity contingencies associated with covering the risks that must be otherwise mitigated – especially if this is a new satellite operator. IODs comprise a relatively small portion of satellite procurements, and it is important to understand the trade-offs involved with such an approach.

Intellectual property arrangements

Many satellite programs involve existing technology in which the satellite manufacturer licenses its existing technology to the satellite operator/purchaser. In some instances, there may be a collaborative effort between the satellite operator and the satellite manufacturer. For example, Skybox Imaging contracted with Space Systems Loral to build 13 small high-resolution Earth observation satellites using a Skybox Imaging design for which SSL had been given an exclusive license. In a satellite program involving existing technology, the satellite manufacturer will license its existing intellectual property (“IP”) to the satellite operator, to the extent needed to operate the satellite and for the operational life of the satellite, and the satellite operator will require that the manufacturer indemnify the satellite operator against third-party claims or suits related to contracted-for use of IP. For programs involving new IP, the parties will need to carefully consider the treatment of IP that is delivered during the course of the satellite manufacturing program. For example, will the satellite operator be contributing IP to the program? If so, does the manufacturer have the right to use such IP on other programs? Will IP be jointly developed? If so, what rights does each party have to further develop and grant licenses to such IP to other parties? Chapter 21 provides an in-depth review of intellectual property issues with respect to satellite programs.

Contract for the launch of the satellite

The contract for the launch of the satellite is typically called the “Launch Services Contract”. The counterparty for this agreement is the launch services provider. A number of governments license and regulate private launch services providers. In the United States, the US Federal Aviation Administration’s Office of Commercial Space Transportation licenses and regulates launch services providers and the operation of commercial launch and reentry sites, as authorized by the Commercial Space Launch Act of 1984 (the “CSLA”).

A few of the specialized key provisions in a Launch Services Contract include:

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3 2015 Commercial Space Transportation Forecasts. April 2015. FAA Commercial Space Transportation (AST) and the Commercial Space Transportation Advisory Committee. Federal Aviation Administration. p. i.

• **Description of services:** number of launches, options for additional launches, the time at which contractual performance by the launch services provider is deemed complete, launch site location and whether alternate sites are available;

• **Price and payment terms:** whether payments are made on a fixed date or on a milestone basis; invoicing mechanisms, late fees, treatment of taxes;

• **Customer rights to additional payload and performance capacity:** may involve additional significant cost and may not be determined until such time as final launch preparations are underway;

• **Launch services schedule and adjustments to schedule, delays:** designation of launch period, launch slot, launch interval and launch date during which the launch services will take place, circumstances under which the customer can be rescheduled (such as for government pre-emption), customer’s rights to postpone the launch services, treatment of customer and contractor delays;

• **Refight option:** whether customer can purchase an additional launch service in the event of a launch failure and the timing and costs associated with the refight;

• **Representations and warranties:** for example, the launch services provider might represent that it shall maintain certain certifications and standards and otherwise abide by common standards, practices, methods and procedures in the commercial aerospace industry;

• **Licenses and regulatory clearances:** identification of parties responsible for obtaining licenses, authorizations, clearances, approvals and/or permits for obligations; compliance with government requirements including export and import laws, regulations, rules, licenses and agreements;

• **Non-recurring or recurring launch vehicle qualification criteria:** process for qualifying new and untested or significantly reconfigured launch vehicles, qualification after a launch failure;

• **Limitations on liability and disclaimer of warranties, risk allocation for launch site activities:**

• **Cross-waivers of liability and indemnification:** Each party agrees not to sue or otherwise bring a claim against the other party, related third parties or the U.S. government or its contractors or subcontractors for any injury, death, property loss or damage in connection with activities relating to the launch, and to indemnify the other party to the extent that claims of liability by such related third parties are not covered by third-party liability insurance. These are requirements in connection with the CSLA, as further discussed below;

• **Security interests:** whether customer may grant a security interest in its rights under the contract to a lender that provides financing for the performance by the customer of its obligations under the agreement (i.e. payment);

• **Termination rights by each party:** termination for convenience, termination for delay.

Technical issues, including satellite encapsulation and integration, are contained in the Statement of Work and Interface Control Document and are typically included as exhibits to the Launch Services Contract.

There are core interdependencies between the Satellite Purchase Agreement, the Launch Services Contract, the customer contracts and the financing terms for a commercial satellite program. For example, late delivery of the satellite would result in the satellite operator losing revenue that it would otherwise have received through the provision of satellite capacity to its customers as of the anticipated date of commencement of operations. The satellite operator
may have an obligation under its customer contracts to commence services as of a certain date, the failure of which could result in the contract being terminated. The satellite operator may have a long-stop date under its financing, after which the satellite operator will be in default and the loan will be subject to acceleration.

Key lender-specific provisions include assignment rights and, potentially, lender access to the project. Lenders will be concerned with an overall “bankability” analysis, understanding how, for example, late delivery might be mitigated with liquidated damages and linkages to customer contracts. Certain unmitigated risks at the program level might be addressed via additional contingent equity or other additional credit support.

**Recent trends and developments**

An important recent development having an impact on the provision of launch services has been the resurgence of low-Earth orbiting constellations. These programs involve significant manufacturing undertakings, with groupings of satellites being built and launched together. Such programs may involve more than one launch services provider, and/or a back-up launch services provider. There are significant contracting differences between manufacturing and launching a single geosynchronous satellite versus issues that arise in the context of a constellation. A launch services contract for a constellation of satellites would include the provisions introduced above but would be significantly modified to reflect complications associated with payload delivery of multiple satellites, and scheduling launch services for the program. This would include making provision for a much more complicated set of sequencing issues and interdependencies between, for example, the timing of the delivery of the satellites and the launch of the satellites, including treatment of launch postponements at the individual and/or full schedule level, and issues such as whether the launch of multiple satellites will be grouped on a single launch. Payment schedule, termination schedule and many other provisions are necessarily more complicated. Constellation replenishment must also be considered. Many of these constellations involve or have involved new launch services providers or new vehicles. How are these providers and/or vehicles qualified as flight ready, to the satisfaction of the satellite operator and its lenders or investors? How is schedule risk managed? How is the insurance program organized? All of these issues must be carefully considered and understood as it relates to the overall program.

Another trend in recent years has been creative partnering between satellite operators seeking to develop new programs. This has stemmed from the need to share financial or other resources. For example, the joint procurement of four all-electric Boeing 702-SPs by two regional satellite operators, Asia Broadcast Satellite and Satmex (now Eutelsat Americas), was the first time electric thrusters were to be used to carry a satellite from initial transfer orbit to final geostationary position. By joining forces, the regional satellite operators were able to achieve an economy of scale in satellite and rocket production usually reserved for larger satellite operators. The purchase and delivery of the satellites was reportedly governed under a joint procurement agreement. Another example is the Horizons 3e satellite, a joint effort between JSAT and Intelsat, in which Intelsat contributed the orbital slot at 169E, and part of an ongoing 10 year cooperation and joint venture with Horizons 3e representing the fourth

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joint satellite project between them. Other examples involve hosted payloads and various forms of shared ownership of satellites, sometimes dubbed “condosats” – a moniker some consider descriptive and others misleading. Other creative approaches have involved satellite manufacturers sharing risk through providing vendor-financing.

Each of these joint efforts have the same program considerations in a procurement by a single entity, but with varying complications of certain terms that necessarily involving another layer of background coordination and negotiation of rights and responsibilities between the companies. The following questions often arise: How do satellite operators involved in a joint procurement negotiate the various factors associated with program schedule? How do lenders to a program with a hosted payload or condosat arrangement assess counterparty risk? What does “ownership” of a satellite mean on a jointly-flagged satellite, and how are issues such as program management and oversight during the manufacturing process negotiated? What elements are commonly owned in such programs, and how are spare component redundancy and power sharing addressed? How are issues such as lender assignability negotiated when multiple parties are involved? How does one owner ensure that they have quiet enjoyment rights and non-disturbance rights, if the other owner has a lender and that lender wishes to enforce its security interest? How are licensing and coordination issues addressed? How are these programs insured? How do these arrangements impact other program risks and relationships? Each of these and many other factors must be carefully considered and explored.

Insuring satellite programs

Satellite operators will typically insure the cost of the satellite, the launch services and the cost of the insurance premium in the event of a partial or total failure of the satellite. Key coverages on the satellite will include (1) pre-launch insurance, (2) launch and initial operations insurance and (3) in-orbit insurance. Additionally, third-party liability is customarily procured. A satellite operator must ensure that insurance coverage in connection with ground coverage during pre-launch, attachment of launch-risk coverage and a terminated ignition or pad abort event are seamless, since the satellite operator bears the risk of an uninsured loss arising from gaps in coverage. As a result, it is critical that the project contracts and policy language regarding the terms “intentional ignition”, “total loss” and “partial loss” are aligned, otherwise there could be a gap in coverage.

Pre-launch insurance includes all-risks and transit of the satellite, up to the time of “intentional ignition” of the satellite, and such insurance is almost always procured by the satellite manufacturer as a requirement under the satellite manufacturing contract. Risk of Loss passes from the satellite manufacturer to the satellite operator at intentional ignition of the satellite.

Launch insurance is typically procured by the satellite operator and covers all risks of physical loss of or damage to a satellite arising out of the launch process, at the moment of intentional ignition, until the satellite has separated from the launch vehicle. The named insured changes because risk of loss of the satellite passes from the manufacturer to the satellite operator at the time of delivery. For a financed satellite program, the lender will be the loss payee – the party entitled to receive the insurance proceeds in the event of a loss. Launch insurance may also include the first 12 months of operations of the satellite while it is in orbit, the arrangement deemed “Launch + 1” in the industry.

Launch liability insurance usually addresses damage, harm or death in space, in airspace or on the ground, and will name the launch services provider as the named insured. Additional insureds typically include the supplier, the satellite operator, lenders and the government of the launching state. Third-party liability insurance is the insurance to protect against any liabilities brought in any jurisdiction for bodily injury to third parties and damage to third-party property incurred anywhere in the World.8

For U.S. launch services providers, the Commercial Space Launch Act requires launch vehicle operators to have liability insurance up to a required threshold.9 A licensee is not required to obtain insurance or demonstrate financial responsibility of more than $500,000,000 for claims by a third party for death, bodily injury, or property damage or loss resulting from an activity carried out under the license.10 The launch services provider is required to make a reciprocal waiver of claims with its contractors, subcontractors, and customers, and contractors and subcontractors of its customers, involved in the launch services under which each party agrees to be responsible for property damage or loss it sustains, or for personal injury to, death, property damage or loss by its own employees resulting from the launch activities.11

Title I, Section 102 of the recent H.R. 2262, U.S. Commercial Space Launch Competitiveness Act, passed by Congress and signed by the President in November 2015, includes two important provisions relating to commercial satellite launches and insurance. The first provision, §102(b), directs the Administration to reevaluate the calculations necessary to determine the maximum probable loss from a launch and specifically includes a desire of Congress to balance the potential impact on Federal liabilities with the necessary amount of insurance that a private company needs to purchase. The second provision, §102(d), extends the Federal indemnification for launch liability until 30 September 2025.

**Financing of satellite projects**

There is a great diversity in the sources and types of financing available in connection with a satellite program. Potential sources include venture capital, private equity and debt, commercial banks, capital markets, export credit agencies, vendor-financing and anchor-tenant financing. Types of financings range from investments, to unsecured debt, to corporate financing, to project financing, among others. Broadly speaking, in a corporate financing in which the satellite operator as a going concern is receiving financing, the significance of certain program-level risks are reviewed globally in order to determine whether the potential outcomes could result in a material impact on the company, as a whole, and which would affect the company’s ability to pay back its debt. Conversely, in a project financing, the lender looks to the revenues of the project, any insurance proceeds, the project contracts and, in some cases, the work in process, as the source of collateral during construction with limited recourse to the project sponsors. As such, the risks associated with the individual project assume greater importance.

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8 It should be clearly noted that nations that have launch operations have a treaty obligation that specifically requires that launching state to ultimately indemnify any other nation for third-party injury claims arising out of launch operations or the re-entry of vehicles or their parts (Outer Space Treaty, Art. VII). Because of this, nations impose insurance and indemnification requirements on commercial launch and payload companies. In the United States this obligation is incorporated into the Commercial Space Launch Act and the subsequent regulatory actions of the Department of Transportation (FAA).
11 51 U.S. Code § 50914(b)(i).
The sources and types of financings available to a satellite operator will vary, depending on the credit-worthiness of the satellite operator and the type of project, among many other factors. Each approach comes with different trade-offs. While public capital markets often offer a lower cost of capital than private markets, as well as less restrictive covenants, accessing public capital markets comes with a whole set of other requirements and may not be an option for a new market entrant. Equity investors and lenders will have the same considerations, but may view risks through a different lens. Take, for example, pre-launch sales of satellite capacity. While pre-sold capacity establishes a strong market proposition for a program, capacity sold two or three years prior to a satellite even being launched may be heavily discounted when compared to capacity sold on an existing satellite that can provide services today. A lender’s primary concern will be repayment of debt. They will not be sympathetic to an argument that there are additional margins to be found by holding off on sales, while an equity investor who benefits from the upside of the profits may take a different view – but both will be equally concerned with market horizon. Equity investors may also be more likely to support a program with newer, less proven technology if the upside may be great. Lenders will typically prefer a proven technology and will be more likely to seek to minimize risks across the program. A strong satellite operator/borrower with other financing options usually will have more leverage and accordingly will generally be able to negotiate a lighter covenant package with a lower percentage of pre-sold capacity on the satellite, all other things being equal.

Satellite operators with an established track record may view extensive lender involvement as potentially detrimental or at least as hampering their ability to nimbly respond to market considerations. They may press for a lighter covenant package such that lender control is only triggered if certain events occur or ratios are not complied with. A new satellite operator may not have the negotiating strength to obtain such a covenant package; in that case, they may use more restrictive financing early on and then refinance debt once the risk profile has improved, such as after in-orbit testing of the satellite or once financial ratios and percentage of pre-sales creates a stronger credit risk profile. Satellite operators should carefully review their covenant packages with experienced counsel in order to understand how their financing documentation can impact the operations of the company as well as future flexibility of the company’s activities.

Investor/lender due diligence of satellite programs

As part of the legal diligence process, lenders will review, among others, credit, legal, technical and market risk. They will also seek to confirm that adequate insurance requirements have been established and complied with, and that lender-specific endorsements have been obtained prior to the first disbursement of funds. Along with legal counsel, lenders may engage a technical consultant, market consultant and insurance consultant. Lenders will review the satellite manufacturing contract, the launch services contract, the key customer agreements, insurance and documentation of existing debt, along with many other aspects of the program. A full review of lender analysis of satellite operator/borrower risk is beyond the scope of this chapter, but key considerations include the satellite operator’s credit profile, foreign exchange earnings relative to currency debt burden, credit rating of customer parties, assets, liquidity, business profile and management ability, strength of financials, country risk, credit-worthiness

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obligors, the repayment period and the drawdown period. Lenders will also diligence the satellite manufacturer, the launch services provider and key revenue generating customers, among others, and may require financial statements and other information about these parties. As part of their due diligence inquiry, lenders will seek to understand the key milestones and provisions for delay by the manufacturer in the satellite manufacturing contract and how these align with the satellite operator’s rights to change schedule in the launch services contract, as well as the satellite operator’s obligations under the customer contracts and the key customers’ rights to terminate in the event of delay. Lenders will also seek to understand, among other risks, what the impact of delay will be on the overall program, and gaps in liability between contractual obligations that would fall to the satellite operator and, ultimately, to the lender as the lender ultimately bears the credit risk and default risk of the satellite operator.

**Insurance from the perspective of the lender**

Lenders will often require as a condition to loan disbursement that the insurances described earlier in this chapter be in place with premiums paid, and that the underwriters or insurance companies meet certain ratings requirements. Loan documentation will also typically contain an ongoing covenant requiring the borrower to maintain such insurances, as long as the insurance is available on reasonable and customary terms. There may be instances when such insurance is not available. Pre-launch satellite property insurance premium rates and the maximum per-launch coverage fluctuate with the market, based on recent claims. A satellite operator may need to negotiate with its lenders for an appropriate waiver resulting from the satellite operator’s inability to procure the required insurances as a result of market forces. In the event of a total loss, loan documentation associated with the financing of a single satellite will likely require that all insurance proceeds in respect of the total loss be applied to the mandatory prepayment of the credit. In some cases, including loans in which the loan obligor is a sufficiently creditworthy going concern, the loan proceeds may be able to be applied to a replacement program in accordance with a lender-approved replacement plan. In the event of a partial loss, there is typically a threshold amount below which the satellite operator may apply the proceeds as it sees fit, and above which it must use the funds towards a mandatory prepayment or towards a lender-approved replacement plan. This is similar to what might be seen in the context of a non-satellite infrastructure financing.

**Collateral**

In a secured financing, collateral is used to secure the repayment of the satellite operator/borrower’s debt. The customary collateral package includes, during manufacture includes: the Satellite Purchase Agreement (including IP and support after launch), the Launch Services Contract, insurance proceeds, TT&C Contract, or ground facility and associated real property, customer contracts, and governmental authorizations.

Once the satellite is in orbit and operating, the core collateral customarily includes the satellite, the TT&C facility, including the real property upon which the TT&C facility is located, and the ground segment infrastructure, including gateways, network operation center

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and interconnection facilities. The lender will also be concerned with governmental authorizations and the licenses needed to operate the space and ground systems in the event the lender must take possession of the satellite.

The value of a satellite (and of the underlying contracts to manufacture and launch the satellite), is limited without the associated revenue-generating customer contracts. There are limited alternative applications for satellites that are far along in the manufacturing process or that are already launched into space. Similarly, a customer contract, by itself, is not of value unless it can be assigned to a satellite operator with similar coverage and parameters that can fulfill the same customer requirements.14

Pre-sales of capacity will be a key differentiator to lenders and to investors. Customer contracts are the life blood of the satellite project, and they are the core security assuming the lender has all of the other rights it needs to step into the project in the event of a default.

**Direct agreements with key contractual counterparties**

Direct agreements are sometimes a requirement of lenders lending on a project financing basis, where the lenders look to the program for security rather than to the ongoing commercial credit of the satellite operator. The company’s contractual rights to manufacture and launch the satellite are the key assets of the project company during the manufacturing phase. Direct agreements establish a direct line of privity between a lender and a satellite operator’s counterparty. Lenders will customarily seek to have such agreements with the satellite manufacturer, the launch services provider, and other key project participants, covering, among other things, lender cure rights in the event of a satellite operator’s breach, the counterparty’s consent to the assignment of the contract as collateral and acknowledgment of the lender’s security interest in the satellite operator’s rights to the contract, and the obligation that the counterparty provide copies of all notices. A customer will be concerned with preserving its access to the capacity such that the customer would not, as a result of the satellite operator’s security agent enforcing any security over the satellite or taking any physical action over the satellite, lose the contractual benefits of the capacity agreement or be disturbed by the security agent or the senior creditors in receiving access to capacity pursuant to, and in accordance with, the terms of the capacity agreement. The customer would expect, so long as the underlying capacity agreement has not been terminated, that it will continue to have exclusive rights to possession and control of its transponders.15

The lenders may resist a provision allowing the customer to continue to have and enjoy the benefits of the capacity agreement and not be disturbed in receiving the performance thereof notwithstanding any default or breach on the part of the satellite operator under the loan documentation, because in so doing, they effectively make it impossible to move the satellite to another orbital slot. However, under most circumstances, the greatest value of an in-orbit satellite is in the orbital slot for which it is designed and for which existing pre-sold capacity agreements have been contracted for.

There are features of certain satellite programs, especially geostationary programs, that make it more difficult for a customer to seek services elsewhere. For example, in a direct-to-home

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program, it would be difficult for the customer to re-point each satellite dish, for each of its customers, at a new satellite. Because customers are somewhat captive, a direct agreement may be less critical than if the customer were completely free to choose another provider of capacity.

**Creation and perfection of security interests under the U.C.C.**

The process and associated formalities of creating and perfecting a security interest is determined by the laws under which the security interest is governed. In the United States, versions of Article 9 of the Uniform Commercial Code (the “U.C.C.”), which governs the creation and perfection of security interests, have been adopted in all of the states, including New York.\(^\text{16}\) Article 9 applies to a transaction, regardless of form, that creates a security interest in personal property.\(^\text{17}\) A “security interest” is defined under the U.C.C. As “an interest in personal property … which secures payment or performance of an obligation.”\(^\text{18}\) A satellite would be deemed personal property under Article 9.\(^\text{19}\) Thus a security interest in a satellite can be created in the United States by contract, and such security interest will be governed under Article 9.

The creation and perfection of a security interest in other jurisdictions, however, must be carefully researched. A new international convention sponsored by UNIDROIT would create a uniform international system to register security interests in satellites.\(^\text{20}\) However, as discussed below, some industry participants are skeptical about the purpose and benefits of the Convention.

**Perfection of security interests: unidroit space assets protocol as an alternative**

The International Institute for the Unification of Private Law (UNIDROIT) is an independent intergovernmental Organization with its seat in the Villa Aldobrandini in Rome. Its purpose is to study needs and methods for modernizing, harmonizing and coordinating private and in particular commercial law as between States and groups of States and to formulate uniform law instruments, principles and rules to achieve those objectives.\(^\text{21}\)

Approximately 20 years have elapsed since this international organization began developing a legal regime for protecting large mobile equipment that either crosses international borders or would be located in outer space (a geographic location designated to be without sovereignty by treaty). At the time of the commencement of this initiative, asset-based financing was how many airplanes, railroad cars and communications satellites were financed and there was a need for developing a trans-national system to protect lenders and the owners of assets.

The Cape Town Convention on Interests in Mobile Equipment was drafted in 2001 and was designed to protect lenders and owners of large, valuable assets that are easily moved across.

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\(^\text{17}\) U.C.C. § 9-109(a)(1).

\(^\text{18}\) U.C.C. § 1-201(35).

\(^\text{19}\) See U.C.C. § 9-102(a)(44), defining “Goods” under Article 9.


borders during normal activities. The main issue was, of course, the protection of the ownership and collateral security in that asset when it is moved from the country with direct jurisdiction over the asset and company to another jurisdiction with possibly different collateral security and enforcement laws and regulations. The Convention and its supporting Protocols have five basic objectives:

1. to provide for the creation of an international interest which will be recognized in all Contracting States;
2. to provide the creditor with a range of basic default remedies and, where there is evidence of default, a means of obtaining speedy interim relief pending final determination of its claim on the merits;
3. to establish an electronic international register for the registration of international interests which will give notice of their existence to third parties and enable the creditor to preserve its priority against subsequently registered interests and against unregistered interests and the debtor's insolvency administrator;
4. to ensure through the relevant Protocol that the particular needs of the industry sector concerned are met;
5. by these means to give intending creditors greater confidence in the decision to grant credit, enhance the credit rating of equipment receivables and reduce borrowing costs to the advantage of all interested parties.

The Convention itself entered into force on 3 January 2006 and currently has 69 contracting states.

Three different protocols were drafted under this Convention. One was for aircraft, one for railroad cars, and one for space assets. Only the protocol covering aircraft has been signed by enough nations (currently 59) to be in force.

This short description focusing on space assets will not attempt to trace all of the history of these protocols, but only illustrate that over time a number of both financial and technical conditions have changed and what once looked like a very promising international protocol and a stimulus for commercial and private space operations has ended up as a stalled agreement with only four nations as signatories and no ratifications.

However, it should be clearly noted that the business of space-based telecommunications has been, and continues to be, a thriving and profitable business venture for a number of private companies. The existence of a commercial market has contributed to the establishment of rapid global communications to many peoples and nations that otherwise would not have had these opportunities.

During the 1980s and 1990s there was a rapid growth of new private telecommunications satellites. Space-based capabilities grew rapidly, particularly in the use of the geosynchronous orbit for wide area coverage of communications. Today there is terrestrial ground receiving equipment also improved, particularly for small, inexpensive consumer/home receiving antennae. This, combined with more powerful, longer-lasting, and larger satellites enabled a fast development of many services.

The largest revenue generating satellites quickly became those broadcasting television directly to consumers. The financing of new satellite systems was sometimes asset-based, with

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lenders holding financial interests in the space-based assets, either as a whole or for specific transponders incorporated into the asset but dedicated to a specific customer or user. Addressing treatment was part of the backdrop to the Convention.

In asset-based financing, a creditor’s ability to have prompt recourse to the underlying assets in the event of a default is a principal factor in determining how the transaction’s risks, and overall costs, are calculated. Where national legal rules for the recognition and enforcement of security interests present impediments to such prompt recourse, or are materially different from rules in other jurisdictions, the risks (or perceived risks) for the creditor can increase, particularly if, as in the case of aircraft objects, the asset will be moving through different jurisdictions and possibly become subject to such national legal rules at the time of default. The costs of finance tend to be higher as a result of the increased risks. The Convention addresses this issue by establishing an international legal framework for the creation, recognition, registration and enforcement of “international interests” in high-value mobile equipment.24

Over time the largest companies involved in satellite services have matured to the point where other forms of financing expensive space assets are available. This has led to a division among space communication companies between the powerful large companies and the smaller newer entrants (as well as less industrialized nations). The large satellite operating companies, the space insurance industry, and the satellite manufacturers, as a group, now strongly oppose the ratification of the Space Protocol of the Cape Town Convention.25 They argue that it is not necessary since there have been no serious financing issues, and it would increase costs and regulatory burdens unnecessarily. Some also argue that the Convention is directed toward mobile assets, which for these purposes are assets moving across national borders, and that satellites as space objects under the Outer Space Treaty always remain under the jurisdiction and control of one nation.26,27 Others still advocate for its acceptance and for States to become contracting parties to the Protocol.

One interesting aspect of this Protocol is the definition of a space asset. Article 1 states that a:

(k) “space asset” means any man-made uniquely identifiable asset in space or designed to be launched into space, and comprising

(i) a spacecraft, such as a satellite, space station, space module, space capsule, space vehicle or reusable launch vehicle, whether or not including a space asset falling within (ii) or (iii) below;

(ii) a payload (whether telecommunications, navigation, observation, scientific or otherwise) in respect of which a separate registration may be effected in accordance with the regulations; or

(iii) a part of a spacecraft or payload such as a transponder, in respect of which a separate registration may be effected in accordance with the regulations, together with all installed, incorporated or attached accessories, parts and equipment and all data, manuals and records relating thereto.

26 Outer Space Treaty, Articles VI and VIII.
It is interesting to note that although the Protocol specifically deals with “interests in mobile equipment” the discussion surrounding the Protocol was oriented toward communication satellites, which, in 2001 was virtually the only commercially financed category of space assets. However, the original and the slightly amended definition of space assets includes all types of equipment and makes no distinction between government, civil, or privately owned spacecraft. It still is an open question as to how this agreement would be enforced – would governments be obligated to register their satellites? Would components on hosted payloads be registered separately? Or, would the Supervisory Authority and Registry only apply to equipment that was financed through asset-based contracts?

Similarly there are also questions concerning liability, salvage, jurisdiction, and the relationship of provisions of the Protocol with respect to specific national laws, such as the export control regime of the United States, that need to be clarified.28

For purposes of the Protocol, this definition sets up the establishment of a new registration process and system for space assets. Although this has been deemed not to duplicate or interfere with the existing Outer Space Treaty or the Convention on the Registration of Space Objects and the UNOOSA register of space objects,29 it nevertheless does add a potential new burden on the current space regulatory process. And, it should be noted that the treaty definition of a space object is quite vague.30 And, the UNOOSA Registry associates space objects with the launching state (of which each object may have more than one), not with any financing designation and it has no formal method of reflecting the sale, transfer, lease, or other change in ownership. In fact, it does not even require a State to notify the registry when the space object has reached its end-of-life.

But, the UN registry of space objects has proven to be a useful base for identifying most satellites and other objects launched into space, even if it is not a basis for a legal/ownership/financial interest identification or dispute.31

Finally, although there have been international discussions about the formation of a new registry under this Protocol, it has not been implemented, nor is it likely to be completed any time soon. The Protocol also calls for the formation of a Supervisory Authority to oversee its implementation. The Supervisory Authority as well as the registry would be fee-based and self-financing. Although international organizations such as the International Telecommunication Union have expressed interest in hosting such a registry, no formal processes have begun to implement this. Many nations have also expressed reservations focused on the imposition of yet another organization for space activities that includes overlapping jurisdiction with the existing UN and ITU space offices as well as with national law.

In spite of the objections, the Protocol to the Convention on International Interests in Mobile Equipment on Matters Specific to Space Assets was signed at a meeting in Berlin, Germany on 9 March 2012. However, only four nations have signed this Protocol and none has ratified it. Subsequent to the Berlin Agreement, the ITU has issued a report detailing activities to be discussed under the protocol including the establishment of a new Supervisory Authority and

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31 An interesting and current discussion of these topics can be found in: Bruce Cahan, Irmgard Marboe, Henning Roedel, Outer Frontiers of Banking: Financing Space Explorers, and Safeguarding Terrestrial Finance, IAC–15,E6,1.5x29408, Jerusalem, Israel October 2015.
Registry. To date, although meetings and discussions have been held, no concrete action has been taken to establish any new legal regime.

Looking forward and other areas of inquiry

This chapter has introduced some of the critical components of a commercial satellite program as well as some of the key current topics impacting such programs. There are basic requirements and contractual arrangements associated with any program, but these are necessarily tailored to each individual program. Many of the issues that concern a satellite operator will also be important to potential lenders and investors, although the ways in which the risks are viewed and addressed vary. There are additionally different sources and types of financing, each with different considerations. Fully describing and analyzing the proper structuring of a satellite financing arrangement is beyond the scope of this chapter. It is, nonetheless, important to emphasize that understanding the risks and the points of leverage in the various negotiations between investors and lenders as well as the different financial and legal formats of satellite projects is central to a successful financing arrangement. These additional factors should also be fully understood by all parties to such a negotiation and transaction.

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