

Legal Issues Presented by Hosted Payloads

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Although there are various types of hosted payload missions, the typical hosted payload involves using excess capacity on a commercial satellite to accommodate additional instruments or sensors. Very often, the hosted payload has been a government payload. The opportunity to have a small payload hosted on a large commercial satellite has enabled the U.S. Government, and other entities, to operate additional payloads in a timely and cost-effective manner and to address their needs based on shorter planning cycles. The commercial satellite operator also is able to leverage its satellite bus, launch vehicle and satellite operations in a cost-effective manner. Because of the success of hosted payload missions and the increasing constraints on space budgets, satellite operators, manufacturers and governments have created branches to identify and address the opportunities presented by hosted payloads. With these opportunities, however, comes additional risk. Commercial satellite operators, insurers and other parties to these ventures need to evaluate the risks and the rewards from a business perspective and craft legal instruments to identify and allocate the risks.

Risks to the primary payload operator include manufacturing and other delays prior to launch, and the potential of harmful interference to the payload or satellite bus in-orbit. Several interesting legal issues are presented. For example, if there is a decrease in available on-orbit power, which payload will be cut-back or turned off? Could such a scenario lead to a “partial loss” under an insurance contract?

Contractual parties involved in a typical hosted payload arrangement will include the Host (usually a commercial satellite operator), the Client (the entity seeking to have its payload included or “hosted” on the satellite), the Manufacturers (of the primary payload and the hosted payload), the Launch Services Provider, and the Insurer(s). Terms and conditions between and among these Parties need to address compensation, cost sharing, control, and insurance-related matters. This paper will evaluate these and other legal issues presented by hosted payloads.

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I Introduction

In an effort to reduce the cost of accessing space, some companies and governments are turning to the concept of hosted payloads. This budget-driven process is highly likely to accelerate over the next decade. A hosted payload is “[a]n instrument or package of equipment that is affixed to a host spacecraft and operates in orbit making use of available capabilities of that spacecraft, including mass, power, and/or communications.”¹ Hosted payloads are a possibility when the primary payload does not utilize the entire capacity of the satellite and launch vehicle. The owner of a satellite with excess capacity (“Host”) can choose to sell that capacity to a hosted payload customer (“Client”). The hosted payload Client can then design the hosted payload to be integrated with the primary payload on the satellite bus of the Host, who procures the launch of the satellite.

The sale by a satellite owner of the remaining capacity of its satellite to a hosted payload client can be advantageous for both parties. The Host will be able to use its satellite and bus more efficiently while also being provided with a form of revenue. As Northern Sky Research (“NSR”) concluded, “The net effects on the commercial satellite industry, in terms of potential hosted payload revenue opportunities, are enormous.”²

NSR’s “Baseline Scenario” for revenue potential the market can provide includes “cumulative revenue opportunities totaling \$2.2 billion over an 11-year period” from 2010 to 2020.³ The hosted payload Client is provided with cost effective access to orbit that otherwise may not be available. “Placing a hosted payload on a commercial satellite costs a fraction of the amount of building, launching, and operating an entire satellite.”⁴ Intelsat General, the world’s largest satellite operator, claims that “[b]y placing a customer’s payload on our spacecraft, we offer the fastest, most cost-efficient access to space.”⁵

Hosted payloads may need to be distinguished from other “rideshare” concepts. The term “rideshare” can be applied to three different types of space launch opportunities. First, a hosted payload, as defined above, can be considered to be a type of rideshare. Second, a rideshare can be a secondary payload, typically weighing less than 180 kilograms, having its own dedicated space mission that is launched as part of a separate satellite launch contract. Secondary payloads can include nanosatellites, CubeSats, and other small satellites. Typically, there

1 *Hosted Payload Guidebook: Prepared for NASA Langley Research Center*, Futron Corporation, 10 (August 2010), <www.futron.com/upload/wysiwyg/Resources/Reports/NASA_Hosted_Payloads_Guidebook.pdf>.

2 NSR, *Hosted Payloads On Commercial Satellites*, Milsat Magazine (May 2010), <www.milsatmagazine.com/cgi-bin/display_article.cgi?number=1593901906>.

3 *Id.*

4 *Hosted Payloads*, Space Commerce (July 19, 2011), <www.space.commerce.gov/general/commercialpurchase/hostedpayloads.shtml>.

5 *Hosted Payloads*, Intelsat General, <www.intelsatgeneral.com/service-offerings/hosted-payloads>.

will be an attachment/separation mechanism for the secondary payload(s). At some point after launch, the secondary payloads will be jettisoned into space – they do *not* remain with the primary satellite and bus. The launch of such a secondary payload cost as little as \$4,000,000 to \$5,000,000 for 180 kilograms to LEO.⁶ Third, a launch vehicle may be able to launch more than one spacecraft and such satellites are co-manifested on the same mission. In this paper, the term “hosted payload” refers to the first type of rideshare. The term “rideshare” will be used to refer to the second type of rideshare opportunity.

While hosted payloads may be cost effective, they also create a number of complex technical and operational issues. Technical issues include how the hosted payload will interface with the bus, how telemetry will be communicated, and how the hosted payload mission data will interface with the primary payload communication system. Operational issues include the physical location of the hosted payload on the satellite, on orbit check out/acceptance testing, sharing of the ground segment, operational communications and normal operational roles and responsibilities. The technical and operational issues involve risks that should be contractually allocated between the parties. This paper will identify and evaluate many of the contractual issues created by hosted payloads with a focus on the allocation of risk. A hosted payload contract will need to address the allocation of risk in the case of late delivery of the hosted payload, launch delay or failure, degradation or failure of the satellite bus, damage to the primary payload and movement of the satellite to a different orbital slot. Generally, to protect the interests of the Host and the Client, the risk allocation should be structured so that each party bears responsibility for the harm they may cause.

II Benefits of Hosted Payloads

The increased attention that hosted payloads have received is in large part thanks to the numerous potential benefits they offer hosted payload customers and satellite owners. Hosted payloads are beneficial because they “leverage a commercial satellite bus to gain timely, economical and responsive access to geosynchronous orbit.”⁷ However, hosted payloads are not new and the concept has been explored and implemented in the past mostly for governmental and experimental purposes. By early 2010, there were “less than 10 hosted payloads on commercial satellites for use by various government agencies around the globe.”⁸ While usage in the past was low, the trend is towards more use of hosted payloads because they offer quicker access to space, low costs, flexibility and another revenue stream for satellite operators.

6 Foust, *New Opportunities for Smallsat Launches* (August 22, 2011) <www.thespacereview.com/article/1913>.

7 *Hosted Payloads*, Intelsat General, <http://www.intelsatgeneral.com/service-offerings/hosted-payloads>.

8 *Hosted Payloads*, Milsat Magazine.

One of the most important benefits of hosted payloads is the decrease in the time required to access space with a hosted payload compared to launching a dedicated satellite. While this benefit applies to both government and private companies alike, “[h]osted payloads can allow the government to plan and implement space missions on shorter cycles compared to the time it takes to procure an entire satellite—typically 24 months versus 7 to 15 years.”⁹ A NASA study of its hosted payload missions reported that “the hosted payload program schedules generally ranged from 2 to 4 years.”¹⁰ Space Systems Loral (“SS/L”) estimates that “[h]osted payloads can be integrated and launched within the typical commercial GEO satellite timeframe of 22 to 36 months.”¹¹ SS/L advertises that it “supplies all major satellite operators with 5-7 new satellite programs per year and 5-7 launches per year in multiple orbit locations. SS/L currently has 22 satellites in backlog with many of these spacecraft able to accommodate hosted payloads.”¹²

Along with short schedules, hosted payloads cost far less than the manufacture and launch of a dedicated satellite. Iridium advertises that its “hosted payloads are available at a fraction of the cost of designing, building, launching and maintaining dedicated platforms in space.”¹³ The reduction in cost can be attributed to the fact that the Host often “only charges for the integration of the payload with the spacecraft and the marginal use of power, launch services, and other resources.”¹⁴ As an example, for one government program it was estimated that “it would cost approximately \$500 million to launch a dedicated free flyer to satisfy 100% of the technical questions associated with the experiment. The hosted payload ended up costing \$65 million and should satisfy 80% of the technical questions.”¹⁵ In addition, “[l]arge cost reductions can result from shared integration, launch and operations with the host satellite, especially over dedicated missions. Costs are also low if the experimental requirements adequately match the capabilities and available resources of the host spacecraft.”¹⁶ The low cost of hosted payloads compared to launching a dedicated satellite is certainly one of the driving forces behind their growth in popularity.

9 *Hosted Payloads*, Space Commerce.

10 Mark Andraschko, Jeffrey Antol, Stephen Horan, Doreen Neil, *Commercially Hosted Government Payloads: Lessons from Recent Programs*, Aerospace Conference, IEEEAC paper #1434, Version 1, 12 (Oct. 22, 2010), <<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5747491>>.

11 *Hosted Payloads Fact Sheet*, Space Systems Loral, <www.ssloral.com/downloads/payload/hosted_payload_fact_sheet.pdf>.

12 *Id.*

13 *Hosted Payloads*, Iridium, <www.iridium.com/About/IridiumNEXT/HostedPayloads.aspx>.

14 *Hosted Payloads*, Space Commerce.

15 *Id.*

16 *Hosted Payloads Fact Sheet*, Space Systems Loral.

The low cost and short schedule for hosted payloads makes them flexible and ideal for numerous government and private purposes. Iridium claims that “[a] wide range of government and industry organizations have expressed interest in Iridium NEXT hosted payloads.”¹⁷ The interest is so broad because, as Intelsat General points out, “[e]ach Intelsat General Hosted Payload is designed to match a specific government or scientific need, such as communications, earth observation, defense or remote sensing.”¹⁸ This flexibility is appealing because it allows an organization to utilize multiple hosted payloads rather than one satellite with multiple payloads. As a NASA study explained, “[a] series of hosted payloads reduces the risk of total mission loss, reduces overall mission cost, and also allows flexibility for the mission development to be phased to fit within future NASA budget profiles. The hosted payload approach allows simpler payloads to be developed and launched as a form of risk reduction and allows technology to be infused in each subsequent payload.”¹⁹ Flexibility allows for experimentation because the risks are relatively low with the lower costs and shorter lengths of time invested in hosted payloads. One of the most visible and successful hosted payloads is the Commercially Hosted Infrared Payload (“CHIRP”). The CHIRP payload was built by Orbital Sciences for the U.S. Air Force and its sensor monitors missile launches. CHIRP is hosted on the SES-2 communication satellite operated by SES in the GSO. This program has been so successful that the Air Force has requested funding for a follow-on mission.²⁰ Hosted payloads also benefit the satellite owner in one very important way—revenue. “Hosted payloads have the potential to bring a significant amount of new revenue to the industry... They make the addressable market bigger.”²¹ The extra source of revenue acts as a financing mechanism. For example, - “the new Intelsat22 satellite will in part be financed via a \$167 million contract to host a UHF payload from the Australian Defence Force.”²² Some satellites are now being designed with the capability to accommodate a hosted payload. “Iridium is hoping for hosted payload contracts to cover a material part of the estimated \$2.7 billion cost of the [Iridium NEXT] system, betting that the opportunity

17 *Hosted Payloads*, Iridium.

18 *Hosted Payloads*, Intelsat General.

19 Mark Andraschko, Jeffrey Antol, Rosemary Baize, Stephen Horan, Doreen Neil, Pamela Rinsland, Rita Zaicewa, *The Potential for Hosted Payloads at NASA*, NASA Langley Research Center, 3 (2011), <http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20120003420_2012003757.pdf>.

20 *After Hosted Payload Success, U.S. Air Force Plans Follow-on*, Space News (April 16, 2012).

21 Paul Dykewicz (quoting John Hane), *Finding Compromises is Integral to Forging Hosted Payload Deals*, HostedPayload.com (Oct. 24, 2011), <www.hostedpayload.com/blog/finding-compromises-is-integral-to-forging-hosted-payload-deals>.

22 Ian Fichtenbaum, *Bumming a ride to orbit*, Near Earth LLC, 2, <www.nearearthllc.com/analysis/presentations/vol5.8.3.pdf>.

to use space aboard its new set of sixty-six satellites will prove irresistible to potential users.”²³

Up to \$250 million may be generated for Iridium between 2012 and 2017 from such hosted payloads.²⁴

In a tough economy, the secondary source of revenue hosted payloads provide is important.

III Drawbacks of Hosted Payloads

Despite all of the projected benefits of hosted payloads, to date they have not been used extensively. As an updated NSR report explains, “[t]he lack of public announcements and multiple signed contracts in recent years has led to serious questions on the hosted payload proposition. Numerous deals that have been expected by the industry have not materialized.”²⁵

However, “[a]lthough the industry is in agreement that little has and will happen in the short term, it is certainly not faltering as a viable market proposition over the long term.”²⁶

One of the drawbacks of hosted payloads arises from the complexity of their contracts. The contractual scheme is more complicated, and contracts take more time to negotiate and close. There are “more parties at the table working out deals (including the operator, the manufacturer, and the government client) that enter discussions with different sets of agendas, concerns, and constituencies who may raise various issues regarding hosted payloads for their own reasons.”²⁷

Overall, “[w]hat appears to be lacking is agreement between negotiating parties on a number of issues including the basic core of a business model that is beneficial to the satellite operator, satellite manufacturer and hosted payload client.”²⁸ A major piece of the business model involves legal issues and the allocation of risk. As with most business deals, if the parties have a good relationship, the legal issues will be facilitated.

IV Legal Issues

The launch of a satellite into space involves a complex web of contracts. A hosted payload adds another contractual layer. Any time there are this many

²³ *Id.*

²⁴ *Iridium: Aireon Air Traffic Venture Can Fly without Another Investor*, Space News (June 19, 2012).

²⁵ *Hosted Payloads on Commercial Satellites, 2nd Edition: Report Summary*, Northern Sky Research (March 2012), <<http://72.10.32.116/research-reports/satellite-communications/hosted-payloads-on-commercial-satellites-2/>>.

²⁶ *Id.*

²⁷ *Hosted Payloads*, Milsat Magazine.

²⁸ *Hosted Payloads*, Northern Sky Research.

contracts and extremely large amounts of money involved, risks must be identified and allocated and legal issues are sure to abound. This paper focuses on certain contractual issues between the hosted payload Client and the Host. Unless otherwise specified, it should be assumed that the Host is also the operator of the satellite and the owner of the primary payload.

Hosted payloads raise a number of unique legal issues thanks to the unusual nature of satellite technology. One attorney compared the hosting relationship to commercial real estate.²⁹ He described it as a situation in which the hosted payload Client is “custom building its own special room and asking [the Host] to insert it into their larger building in perpetuity.”³⁰ Once the satellite is launched into space, the hosted payload can never be removed from the satellite, but the satellite does not operate in perpetuity. Therefore, a hosted payload customer purchases an indefinite “lease” on a satellite, but can only utilize that purchase for a limited time.

This unique combination of an infinite “lease” and a finite utilization, placed in the shallow legal precedent of commercial space law, leaves lawyers with the task of creating new contracts to deal with the legal issues of hosted payloads. So far, there are no standard terms and conditions for hosted payload contracts.³¹ In creating a contract for a hosted payload, one practitioner noted that “[t]he first challenge was finding the right kind of contract for hosted payloads because there was no contract model to look back on...[W]e didn’t really even have a good contract model that we could pull off a shelf and say ‘this is the type of contract we need.’”³²

One of the key issues in the creation of a hosted payload contract is the identification of risk. These risks can include late delivery of the hosted payload, launch delay or failure, spacecraft operational degradation or failure, hosted payload harm to the satellite bus and/or primary payload, electronic or physical interference with the primary payload, satellite bus or primary payload degradation or failure, and ability of the satellite Host to move the satellite to a different orbital slot.

Most of the risks addressed in a hosted payload contract can be assigned through an analysis of priorities, risk, and responsibilities. The primary payload has the highest priority because the satellite owner has far more funds invested in the success of the mission. The hosted payload is the second priority. This prioritization resolves many of the issues, and other issues are resolved by the concept that each party bears the responsibility for any delays or damage caused by that party. There are intricacies within this framework. For example, if the hosted payload owner is a governmental entity, the complex regime of government contracts comes into play. Solutions to some of the more common and pressing issues are described in greater detail below.

29 Matt Fussa, *Matt Fussa*, HostedPayloads.com, <www.hostedpayload.com/index.php?q=news_maker/matt-fussa>.

30 *Id.*

31 *Hosted Payloads*, Milsat Magazine.

32 Fussa, *Matt Fussa*.

A Delays and Failures

One issue that is nearly inevitable for projects with as many moving parts as the launch of a satellite with a hosted payload is the possibility of delays. When a company is manufacturing a satellite or a payload, great care is required due to the large amounts of money involved and the extremely high risk of failure from even minor mistakes. Launching a satellite into space requires meticulous planning, and delays by any party to the launch can have significant consequences. The allocation of risk in the case of the late delivery of the hosted payload or launch delay generally follows the model of each party bearing the risk for delays they cause.

1 Late Delivery of the Hosted Payload

The hosted payload must be delivered to the party that will integrate the payload with the satellite in sufficient time to complete the integration prior to the scheduled launch date. If a hosted payload Client delivers the hosted payload late, it may expose the Host to the risk of a delayed launch. This is a risk that the hosted payload Client should bear. One way to mitigate this risk is to require the hosted payload Client to supply the Host with a dummy payload, which is a weight sufficient to simulate the hosted payload. The European Space Agency has required that a hosted payload contract include a clause stating that, “[i]n case the [hosted payload] is delivered late, the [hosted payload] provider undertakes to deliver a dummy payload at no cost.”³³ It may be preferable to require the dummy payload to be delivered well before the hosted payload delivery date since time may be short after the delivery date. If the Host is provided a dummy payload, it should be able to proceed with the launch of the satellite as if the hosted payload was integrated in the satellite. Dummy payloads are also used for rideshare arrangements. The owner of the primary rideshare requires the secondary rideshare to provide a dummy, often at least a year in advance of the scheduled integration date. Technical issues with hosted payloads are far more complex than for rideshares, however, because the hosted payload must be integrated with the satellite and bus.

In appropriate situations, the parties also can mitigate some of the risk of hosted payload delay by moving up the required delivery date by a period of time well before the day the hosted payload must arrive for integration. The Host can require the Client to pay a monetary penalty for every day that the hosted payload is late. The monetary penalty can vary depending on numerous factors and can escalate over time. If the hosted payload is not delivered by the integration deadline, integration can proceed with the dummy payload instead of the hosted payload. The integration deadline must leave adequate time to integrate the dummy payload with the satellite and bus and address any technical issues raised by the absence of the planned hosted payload.

33 *Announcement of Opportunity for hosted payload on board EDRS satellite*, European Space Agency, 9 (June 27, 2011), <<http://emits.esa.int/emits-doc/ESTEC/EDRShostedpayloadAO.pdf>>.

If the hosted payload is late, the hosted payload contract should clearly provide that the satellite owner is under no obligation to delay the launch or to include the hosted payload. The satellite owner can proceed to launch without the hosted payload. Additionally, depending on the structure of the payments, the hosted payload Client could be saddled with further monetary obligations to the satellite owner. For example, the hosted payload Client may be contractually obligated to pay the Host for in-orbit operation of the hosted payload for a period of time that may extend for the life expectancy of the primary payload. In such situations, the contract should address how this will be handled if the hosted payload is not launched due to no fault of the Host.

2 Launch Delay

One of the most essential elements of a hosted payload relationship is the launch of the satellite into orbit. The satellite owner typically contracts with a launch service provider for the launch of the satellite. This contractual relationship sets a schedule for delivery of the satellite to the launch base, and the integration, of the satellite and launch vehicle that coincides with the availability of a launch. The launch service agreement typically will address delays in great detail and carefully define “Excusable Delay” and other key terms. Substantial monetary damages may be assigned to a party causing an inexcusable delay. Likewise the launch services contract may provide termination rights against a party that causes substantial and/or inexcusable delays.

When the delay is attributable to the satellite owner, it typically bears all of the responsibility. While the satellite owner may bear the responsibility, any monetary risk will depend on its contractual relationships with the launch provider and the hosted payload Client. Very often, a portion of the fee in the hosted payload contract has been included to help offset the cost of the launch. If this is the case, the hosted payload Client may seek compensation for launch delay for which the Host is responsible.

If the hosted payload actually causes a launch delay, it generally should bear all of the responsibility in its contract with the satellite owner and potentially whatever risk the satellite owner had in its contract with the launch service provider. The satellite owner has invested heavily to procure the launch of its satellite. While the hosted payload Client contributes with its fee, that fee is only a fraction of the cost to the satellite owner. Therefore, the hosted payload Client should pay its fee up front and bear the financial risk for any launch delays it may cause. Notwithstanding, every precautionary effort should be made, including the use of a dummy payload, to ensure the hosted payload does not cause a launch delay. In situations in which the cause of the launch delay is a third party, there can be some elements of shared risk or no fault. For example, “[a] change in the launch service provider’s launch manifest is typically considered ‘no fault’ to either party.”³⁴ In addition, the satellite owner’s contract with the launch service provider may be structured so that the launch service provider bears risk in situations where the launch service provider may be at fault. Whatever risk

34 *Hosted Payload Guidebook*, Futron Corporation, 16.

the satellite owner bears in its contract with the launch service provider for a launch delay caused by the launch service provider should be shared proportionally between the satellite owner and the hosted payload Client because neither is at fault.

3 Launch Failure

A successful launch is never guaranteed. In fact, a total loss or destruction of the launch vehicle and satellite (including hosted payload) will generally leave the parties with no recourse. Sometimes, however, a discounted re-launch may be included in the launch contract. In such situations, the Host and Client should address this possibility in their own contract.

B Issues in Orbit

The satellite owner must insulate itself as much as it can from the risk of the degradation or failure of the satellite while it is in orbit. Once a satellite is launched, there is very little a satellite owner can do to preserve the longevity of its satellite. Aside from some control of location, allocation of power, and other software controlled functions, the satellite owner often cannot do anything to solve problems when the satellite is in orbit. Likewise, the hosted payload Client generally will not be able to repair its payload should a failure of some sort occur in orbit. Therefore, both parties to a hosted payload contract need to address these foreseeable risks.

1 Hosted Payload Harm to Satellite Bus

As covered above in the discussion concerning launch delays, the hosted payload cannot jeopardize the success of the satellite, because it would expose the satellite owner to massive financial losses. The same principle applies when the hosted payload negatively affects the satellite bus while in orbit. If the hosted payload causes the satellite bus to fail, the primary payload will also likely fail and the entire mission will be lost. Therefore, the contract must clearly provide that any failure or abnormality of the hosted payload that could jeopardize the future safety or integrity of the primary payload will allow the satellite owner to take all actions possible to protect the satellite bus at the expense of the hosted payload. For example, the satellite bus can include a system that will disconnect the hosted payload if it draws too much power. The point at which such measures become necessary, and whether the measures are temporary or permanent, will depend on the details of each hosted payload contract. In general, however, the hosted payload must do no harm to the host spacecraft.

2 Hosted Payload Harm to the Primary Payload

This proposition applies equally well to situations where the hosted payload harms the primary payload. The hosted payload contract should contain a clause that the hosted payload shall not directly or indirectly negatively impact the primary mission. This allocation of risk protects the satellite owner's interest, but must not be too onerous on the Client so as to dissuade it from entering the hosted payload relationship.

When the primary payload is harmed by the hosted payload the satellite owner should have the option to subject the hosted payload owner to monetary penalties or shut off the hosted payload. While the specifics will vary, the contract should provide that operation of a hosted payload generally can be temporarily suspended without prior notice in the event of a satellite anomaly including insufficient power. If necessary, operation of the hosted payload can be permanently suspended. While the satellite owner might be able to suspend or shut down the hosted payload, the hosted payload Client is not without recourse, because it can include compensation in the contract. Such terms should be negotiated between the hosted payload customer and satellite operator.

The compensation the hosted payload customer should receive due to temporary or permanent suspension of the hosted payload operation will vary with each contract and the reason for the suspension. If the hosted payload is suspended because it presents harm to the primary payload, the Client will likely bear all of the risk and may receive no compensation. To make the hosted payload relationship more appealing to customers, however, the Host could offer the Client minor compensation for the reduction in the expected life of the hosted payload.

If the hosted payload harms the primary payload as a result of radio frequency interference, the same general rules should apply. The Host or the Client may be able to change the frequencies being used or alter the technical or operating characteristics in an effort to minimize the interference. The party causing the interference should bear the cost of the remedial measures. If remedial measures are impossible or ineffective, the “do no harm” rule will usually come into play and the hosted payload may need to be suspended or shut down.

3 Satellite Bus or Primary Payload Degradation or Failure

Failure or degradation of the satellite bus or primary payload is always a risk, but it is more complex in a hosted payload relationship. The satellite owner typically will agree to use its “best efforts” to maximize hosted payload operations, but this will always be subject to primary payload priorities. This order of priorities, however, means that “the customer has to accept that its payload is secondary, if insufficient resources are available.”³⁵ Therefore, the hosted payload contract needs to establish a balance between the Host’s obligations to the Client and the protection of its own interests. While a Host may seek some concessions from the hosted payload Client to support the proper functioning of the primary payload, if the satellite bus fails, the hosted payload Client may want compensation for the loss of the operation of its payload. Many factors will be involved to determine the appropriate compensation. These factors, such as how long the hosted payload has operated prior to the bus failure, should be addressed in the contract as part of a refund clause.

A satellite owner may be able to offset some of the degradation of the satellite bus, but at a cost. By accepting the fee of the hosted payload Client, the

35 Dykewicz (quoting Hane), *Operators Need to Protect Their Interests*.

Host typically accepts more risk and less flexibility. If in-orbit test reports note electrical power degradation, loss of redundancy of a critical subsystem, thruster malfunction, or other issues that have the potential to impact the hosted payload mission, mitigation plans will need to be developed. Mitigation plans may involve concessions from the hosted payload Client. Depending on the magnitude of the concessions and the structure of the contract, the hosted payload Client may be able to negotiate compensation for the concessions.

Another issue to address in the contract is what happens if the satellite bus continues to operate, but the primary payload fails. Keeping a bus operating when its prime mission is over can be quite costly. Potential resolutions include a partial refund to the hosted payload Client, providing another hosted payload opportunity on another satellite, or providing redundancy from the start by hosting payloads on multiple spacecraft. While the later option is not likely to be the most cost effective solution, if continued operation of the hosted payload is critical, this could be the most effective solution.

4 Movement of the Satellite to a Different Orbital Slot

Another issue that a hosted payload contract should cover is the possibility of a change of the satellite's orbital slot. Movement to a different orbital slot could occur when a satellite owner sells the satellite and the new owner moves it, or the satellite owner might move it for operational reasons. When the satellite moves to a different orbital slot while it is in orbit, the hosted payload may be rendered inoperable or experience a reduction in its operational capacity. The hosted payload Client should have the option to terminate the program. If the Client opts to terminate, the Host may need to compensate the Client for the loss of the expected value of the payload for the remainder of the scheduled life of the payload. If the Client continues operations when the hosted payload is at a reduced capacity, the satellite owner should compensate the Client for loss due to the reduced operational capacity of the payload for the remainder of its life. If the Host changes the spacecraft's orbital location before launch, the Client should have an option to continue the program at the new location or terminate the program. Thus, the risk of a change in orbital location is shared between the parties.

C Insurance

All parties to a hosted payload contract should consider having some form of insurance. Satellite insurance is available for the satellite owner and can be purchased to cover pre-launch manufacturing, launch, and the in orbit life of the satellite. Typically, a satellite owner will purchase a plan that will cover launch and a period of time in orbit. The parties to a hosted payload contract may be able to purchase insurance to cover assumed risks. For example, in one government hosted payload contract, "Most of [the] issues were resolved through the use of insurance." In that particular arrangement, "the insurance in the contract covers launch plus one year of services, beyond which the service fee ceases if the payload is shut down. Termination conditions were also negotiated

into the contract and covered by insurance.”³⁶ Insurance can also be used as a means of mitigation as an alternative to assessing penalties when addressing events of risk.³⁷ Insurance can enable a party to accept increased risks, potentially promoting the completion of more hosted payload contracts.

While many parties insure their assets voluntarily, the inclusion of required insurance in hosted payload contracts varies. Within individual contracts, some failures will be dealt with using insurance, while others will be handled with penalties to the party at fault. Indeed, not all contracts require insurance, leaving the parties with the choice to insure themselves. Alternately, some contracts will require a party to obtain insurance. For example, a hosted payload manufacturer’s warranties for the hosted payload “may include a requirement for [the manufacturer] to carry insurance (e.g., launch and one year of operations) for the hosted payload.”³⁸ If the hosted payload fails, the manufacturer “is generally required to compensate [the hosted payload customer] in the case of an insurance claim in accordance with negotiated terms of the ‘Failure to Perform’ clause of the contract.”³⁹ The role of insurance in a hosted payload contract will need to be determined by the parties during negotiation, but can also be addressed by each party individually.

The use of insurance can be an effective way to protect a party against heavy losses at a relatively low cost. Robert E. Berry, chairman emeritus of Space Systems Loral, has promoted the use of insurance by the government when it is a hosted payload customer.⁴⁰

The government often does not utilize insurance and Berry notes that “[m]any observers consider the practice of the government not buying insurance as de facto self-insurance.”⁴¹ However, many parties cannot afford to self-insure and don’t want to “bet the company”. In such cases, insurance can guard against catastrophic losses at affordable costs. Therefore, insurance is a valuable tool for both governments and private companies alike when addressing the risk that they bear in a hosted payload relationship.

This is a new market, and coverage for hosted payload risks is at an early stage of development. There is no standard form policy. Most coverage issues will be addressed on a case-by-case basis. This is not very different, however, from coverage issues for the primary payload. In fact, many of the issues will be the same. The carrier will evaluate risks associated with the launch vehicle, bus, primary satellite, and operator. Then the carrier will evaluate unique risks associated with the hosted payload and how those risks are addressed in the agreements between the Host and Client.

36 Andraschko et al., *Government Payloads*, 11.

37 *Id.*

38 *Hosted Payload Guidebook*, Futron Corporation, 16.

39 *Id.*

40 Paul Dykewicz (quoting Robert E. Berry), *Part II -- Military Should Focus on Operations, Not Designs, Berry Says, HostedPayloads.com* (Aug. 11, 2011), <www.hostedpayload.com/blog/part-ii-military-should-focus-on-operations-not-designs-berry-says>.

41 *Id.*

Conclusion

Hosted payloads are a mutually beneficial relationship for the Host and the Client. As long as both parties are willing to accept the risks those benefits bring with them, hosted payloads should be an efficient way to offer access to space to a much wider range of parties.

When addressing the allocation of risk, the industry should accept a standard based on a mixture of priorities and responsibilities to resolve many of the issues. Protecting the satellite owner's massive investment in its satellite must remain the highest priority. In order to protect the highest priority, the hosted payload client must bear most of the risk. The issues that cannot be resolved by looking to the priorities will be resolved by standard concepts of responsibility, in which each party is liable for the harm it causes. Additionally, in allocating risks, the parties should seek to allocate specific risks to the party best able to manage or insure those risks.

There are many other issues to address in the contract such as what happens if the satellite or the operating company is sold; how end-of-life of the satellite will be handled; problems that could develop with ground network operations; timing of payments (often periodic payments of ten percent with final payment shortly before launch) and impact on payment obligations of a launch postponement; requirements for prompt notice of any actual/potential delays; documentation of Government approvals, licenses, clearances, permits and the schedule for these items (ITAR issues can be critical); registration of the primary and hosted payloads under the Registration Convention; registration of frequencies (by primary and hosted payload operators); reciprocal waivers that are part of the Launch Contract and flowed down; launch schedule adjustments by launch services provider and Host; termination rights for convenience and default (e.g. excessive launch postponements, consecutive failure of the planned launch vehicle, etc.); dispute resolution; treatment of proprietary information; and the governing law; and, of course, ITAR issues.