

## Hosted Payload Episode 3

*Wiley Connected*

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What is spectrum and what does the FCC say about satellites sharing it? Payton Alexander and Jillian Quigley join host Henry Gola to break it down for the Orbital Debrief. Then, Henry and guest Shiva Goel, Legal Advisor to FCC Commissioner Geoffrey Starks, feel the pull of 2013 Academy Award winner Gravity.

### Transcript

Henry Gola

Hello and welcome to Episode Three of Hosted Payload, the satellite and space law podcast. From the Wiley law firm in Washington, DC, I'm Henry Gola. Spring has sprung in the D.C. area and no matter the season we know that gravity is a constant. Of course, prior to Isaac Newton in 1665, that wasn't the case. Newton's story involves a famous fruit as, according to his 1752 biography, "gravitation was occasioned by the fall of an apple, as he sat in a contemplative mood. 'Why should that apple always descend perpendicular to the ground?' thought he, to himself." Today, my guest Shiva Goel and I will sit in a contemplative mood and reflect on the 2013 movie *Gravity*. But first, big news from the FCC with some new rules set to be adopted for satellite spectrum sharing. We'll explain it all, as my Wiley colleagues Payton Alexander and Jillian Quigley join me for The Orbital Debrief.

Alright, lets kick off The Orbital Debrief. I know my 100-year-old grandma is listening, so before we get too in the weeds, I'm going to provide some high-level basics on spectrum for her and everyone

### Related Professionals

Henry Gola

Partner

202.719.7561

hgola@wiley.law

Jillian M. Quigley

Associate

202.719.4668

jquigley@wiley.law

### Practice Areas

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else. First, radio waves can carry data wirelessly from a transmitter to a receiver, even to and from space. It's why we're here. A radio wave's frequency is the number of times it oscillates in one second, which is measured in hertz. Different radio frequencies, or spectrum bands, can be used for different uses like mobile telephones, Wi-Fi, or satellite connectivity. In the United States, the FCC, or Federal Communications Commission, acts like a local zoning authority for commercial spectrum, deciding what spectrum bands can be used for different purposes. The spectrum your mobile phone uses to connect to a cell phone tower is licensed on an exclusive basis by the FCC to a wireless carrier, like AT&T or T-Mobile. By contrast, satellite systems that transmit into the United States, generally operate in shared spectrum. For Non-geostationary orbit or NGSO satellite systems, i.e., those that appear moving from earth, the FCC has established a priority system for sharing. When one NGSO operator applies to use a particular spectrum band, the FCC opens up what it calls a processing round. Other operators that apply by the deadline to use the same spectrum will be on equal footing with the initial applicant in that processing round. If an operator applies to use the same spectrum after the deadline, a new processing round kicks off and these later round operators must protect the operations of the earlier round grants. Simple stuff. So, with that background in mind, I welcome my colleagues Payton Alexander and Jillian Quigley. Big news in the world of satellite spectrum, as the FCC has released a draft copy of new rules for spectrum sharing. We're going to focus on three of the most important aspects of the order. First, let's start with something all the kids are talking about. Something called degraded throughput. Jillian what does this mean and what does it mean for satellite systems with different processing round priority.

Jillian Quigley

So, degraded throughput is a metric that's used for interference mitigation among NGSO satellite systems and so the order codifies that operators from later processing rounds either need to coordinate with operators in earlier rounds or demonstrate to the FCC that they won't cause harmful interference to those operators. And so for the interference demonstration option, the FCC will require operators to use a degraded throughput methodology to prove that they won't cause harmful interference to incumbent users. So, degraded throughput methodology calculates the level of interference that later round entrants can cause to earlier round entrants, without causing severe signal degradation. And so, when interference succeeds these levels, later round entrants have to adjust their operations to be within the acceptable levels. So, the FCC decided to adopt the degraded throughput methodology over the two other options because it accounts for mechanisms that NGSO systems use to tolerate signal degradation from environmental effects and the analysis can be performed using widely available satellite system operational information.

Henry Gola

Got it. Okay, so environmental effects we're talking things that normally affect how a satellite system operates? Rain fade, things like that? Is that what they're considering here?

Jillian Quigley

Yeah, and so pretty much anything that is a naturally occurring phenomenon that satellite operators would experience, in addition to interference caused by other operators.

Henry Gola

Got it.

Jillian Quigley

So, the big thing with degraded throughput methodologies, unlike the other methods, it takes into account something called adaptive coding modulation, or ACM. Believe it or not, many of us are already familiar with the concept of ACM because it's how operators maintain connection for customers even when the signal quality goes down. So, if I'm watching OG Star Trek reruns on my phone and the network experiences issues, what ACM does is it provides the video ah to become pixelated and it'll degrade in quality instead of shutting the video off altogether.

Henry Gola

Have you, have you ever watched OG Star Trek on your phone?

Jillian Quigley

I have watched it on my TV. I haven't watched it on my phone.

Henry Gola

Payton, have you?

Payton Alexander

I have not.

Henry Gola

I think I've watched William Shatner so the spoken word Rocket Man on my phone on Youtube. But I'm not sure how I've watched OG Star Trek. All right, so is this the end for degraded throughput or is there more in store?

Jillian Quigley

Oh, There's so much more in store. So, the further notice is seeking comment on the appropriate values and assumptions that would be used in the degraded throughput methodology and so that's essentially just the underlying framework that they're going to build off of for those calculations and levels and limits.

Henry Gola

All right. That is some seriously technical stuff but important stuff in terms of spectrum sharing between inter round satellite operators. All right, Payton, second, the FCC has put an expiration date on this priority and this inter round sharing. Talk to me about sunseting.

Payton Alexander

So, the order justifies sunseting as a balance between two competing goals here. So, on the one hand, just like Jillian discussed, it wants to afford some protection to earlier round NGSO systems so that we can ensure a stable environment for continued service and investment. Which is why it'll require coordination or the degraded throughput demonstration for inter round spectrum sharing. According to the FCC, it wants to create some certainty for operators who are worried about the prospect of deploying these very costly systems, only to be unable to use them to their fullest potential due to interference from other operators. But, at the same time, the FCC wants to promote competition from these later round systems without the inter round protections lasting indefinitely. So, the order provides for a 10-year sunset of these protections. NGSO systems will be entitled to protection from later approved systems until 10 years after the first authorization in that later processing round and, after that, all systems in both processing rounds will be treated on an equal basis with respect to spectrum sharing in those situations where no coordination agreement has been reached.

Henry Gola

Got it. Okay, so it's a balance of competition with operational certainty and providing something for first in time for the for the first operators here. That's basically it?

Payton Alexander

Right. Right.

Henry Gola

Okay. Third. The FCC provided some clarification on what it means by quote unquote "good faith coordination," but Jillian, did it require specific information to be exchanged between operators?

Jillian Quigley

So, this order decided not to require specific information about what and about what needs to be shared between operators. Instead, the FCC listed several quote unquote typically publicly available satellite specs that it quote unquote "expects satellite operators won't withhold during coordination." Um, in addition to this the order also made clear that any coordination has to be done in good faith and then it reiterated that failure to do so would result in fines, modification, or even termination of NGSO licenses. So, this is some pretty serious stuff.

Henry Gola

Yes, so some strong language but some broad and malleable contours there from the FCC on good faith coordination. All right. So, thanks for these explanations. Payton, what's next in this proceeding?

Payton Alexander

Right. So, the FCC is going to vote on the order and further notice at its April 20, 2023 meeting which is coming up. The new rules will become effective once they're published in the federal register. The federal register is also the trigger for the further notice on degraded throughput specifics with comments due 45 days after publication.

Henry Gola

All right. That is the crispest orbital debrief we've done thus far and I thank you for that. Thanks so much and we'll see you next time.

Ok, welcome back to Hosted Payload. Today, I am joined by Shiva Goel. He's the legal advisor for wireless and international issues for FCC Commissioner Jeffrey Starks. Shiva, welcome!

Shiva Goel

Thanks, Henry! Really happy to be here.

Henry Gola

All right. So, today we're going to be talking about the movie *Gravity*, which was released in 2013 it netted seven Oscars, including a best director nod for Alfonso Quaran. Shiva, I'll give a little description of the movie and then I'm going to let you weigh in with your thoughts. So, it stars Sandra Bullock as a scientist, Dr. Ryan Stone, on her first space mission and George Clooney as veteran astronaut Matt Kowalski. They're part of a mission on the space shuttle explorer to service the Hubble telescope and they try to survive after space debris from an exploded Russian satellite strikes the explorer in the Hubble and cuts off communication to mission control. Shiva, in FCC parlance, comments in support or petition to deny for *Gravity*?

Shiva Goel

Ah, well good, good question. Maybe this will be an informal objection. But that is a real sort of inside baseball comment, right? I love this movie. I had seen it before, I was happy to rewatch it, you know, almost ten years later. But sort of really beautiful movie, with obvious connection to, you know, significant matters of space policy here. And I think just a really interesting historic frame of reference, right? About how Hollywood, how the public, was viewing space back then in comparison to how it sort of might view it now, right? Like, a lot has happened since this movie was filmed that, that's, really really exciting. Um, and the sort of, you know, "I am alone in space," a fairly dismal sort of place to be, a lonely place to be, you know I'm not sure that's the sort of hot take now when you're looking at what folks are doing and interest in space tourism and so on and so forth.

Henry Gola

Yeah, but right of course. Yeah, there's a lot of company. Well, first of all, you know the ISS as we all know is going to be transitioning out of service and it's going to be replaced by commercial offerings. That's upcoming within the next decade. So certainly, change there. You can't talk about gravity without talking about orbital debris and, you know, that term often gets blank stares from friends and family. But, when you say you know like in the movie *Gravity*, a light bulb goes off and they're like "Oh yeah, I know what that is," right? So, Thoughts on how it was presented in this movie, Shiva?

Shiva Goel

Yeah, I mean you know debris was really – and I don't think I appreciated this until I rewatched it – but, it was the main plot catalyst here, was, you know, a massive debris field. And, you know, the sort of storm was caused by a Russian ASAT weapon that that hit an old satellite. And that in turn, in the theory of the movie right, causes a huge chain reaction and takes out virtually every communication satellite in earth orbit and um and you know every 90 minutes based on you know where ah Kowalski and Stone are servicing the Hubble. You know it just, it is this, it is their their deadline, right? To fix something, to get to safer ground, to figure out what to do. In terms of what I think about it, that chain reaction part of it and how quickly it happens, ah, not particularly accurate, right? I think there's a line where Kowalski, who gives like lots of interesting educational commentary throughout the ah throughout the movie, as long as he lasts throughout the movie. You know he says, "All of North America is pissed off right now because they can't access Facebook." And maybe that's not exactly how the internet backbone works but, but like certainly a topical issue and totally inspired by real events.

Henry Gola

Right.

Shiva Goel

And however, sort of, dramatized it was for a 105-minute movie, it portrays a real risk that has happened. And it's sort of, you know, as you know, becoming more of a policy conundrum. So, I thought it was a you know, interesting, an inaccurate but ah, a fair game portrayal here. Yeah.

Henry Gola

Yeah, right? At the time the movie was made there had been collisions in low earth orbit, so it was not something out of the realm of possibility. And the Kessler effect, as it's known, was you know published in the late 70s, I believe. And then studied thereafter. But yeah, even since this movie's come out and you know in the last year or two, there's been purposeful explosions of satellites in space again. So, debris is real and it's a real issue and it's not going away. I want to go back to something you said. So um, you talked about the changes between when the movie came out and now and, sort of you know, the Stone character being alone in space and sort of talking Houston in the blind, right? That's what she and her and Kowalski both are sort of

talking to no one on earth, and then eventually Stone talking to no one because Kowalski floats away. What do you think has changed most between 2013 and 10 years later?

Shiva Goel

Um, you know so, so much. I mean, I think that it's hard to pinpoint when this actually happened in time, right? But if you look at it, I'm not sure if this is exactly 2013 or you know 2011? It's sort of give or take. But if you look at that point in time. You know, what are folks celebrating? They're celebrating, you know, the voyager - a space probe from the 70 s - has reached interstellar space. That's cool. It's traveled billions of miles. That's cool, but modest in terms of, you know, what we're doing in space exploration. I think like, the Curiosity Rover might have landed on Mars around this time too and that's, you know, obviously a more significant event. Um, but when you look at the commercial side of things, right? SpaceX and Orbital pre-merger and then pre-acquisition by Northrop, they are just beginning to run the first commercial cargo missions to the ISS. The Falcon Nine I think launches its first commercial payload and SES satellite sometime around this time. The year escapes me, but sometime around this time. Virgin is sort of touting space tourism as a model. Worldview is dealing the same thing - view with a v-i-e-w, not v-u. And, you know, on the regulatory side we're sort of looking at our procedural rules. But we're not really, ah, looking at ways to keep up with fast-paced changes in space technology. Um, so it really was just at the beginning, at the cusp, the sort of commercial development of space that we see now. And all of that seems to have taken place now where it, you know. Launches are easier to get. They're more flexible. They're more tailored to your payload. They're cheaper, ah, commercial companies are doing a whole lot more for NASA. Broadband satellite constellations are um, you know, ah making headway in getting everybody connected. Earth imaging satellites. I think that's another sort of, where they've bent to the cost curve. They've significantly expanded access to, you know, data and images from earth and a lot of that, at least the momentum, like, seems to have followed. When this movie was created it was, it was still in the nascent phases when they were filming this movie.

Henry Gola

Right. I mean, all that's a great point and I, you know, you said the earth imaging satellites. I thought it was an interesting point and one that I'm not sure was a great reason. Was they. Is they said the Russian satellite was shot down because it likely was a spy satellite which to me means that the fact that there was a Russian spy satellite was some sort of secret where, today, I think we can readily assume that Russia, China, as well as the United States, all utilize various earth observation satellites to keep track of what's going on on the ground.

Shiva Goel

Yeah, yeah, no super interesting and perhaps another aspect of this that is, you know, good movie inspiration. But, you know, this this isn't a documentary up there. So.

Henry Gola

That's right, that's right. So, you know, we talked about how, there, a lot of this movie is um the Sandra Bullock character Dr. Ryan Stone by herself in space. A couple of episodes ago we talked about The Martian where Matt Damon's character is alone on Mars. Do you prefer the space movie where it's sort of a solo person or more of like the buddy or group in space?

Shiva Goel

Yeah, that that is a good question. Um I think I kind of prefer the solo version of this, right? It is so much more gripping. It becomes a little bit more of a psychological thriller, equal part sort of you know, suspense built up just because of what's happening in someone's head and not necessarily, you know, strictly based on the challenges they're facing in space. And that's a pretty, you know, pretty interesting to mention. But you know it depends on mood, right? There's always room for a feel good movie, where you know, we confront some challenge in space as a nation or as a world and the country comes together. The world comes together. And there's a celebration at the end and, yeah, certainly there are movies that have followed that formula too and there's a place for that.

Henry Gola

Yeah, what's interesting is that, and now that I'm thinking about it too with The Martian and this movie, they both - maybe less so in this movie on purpose - but they both involved cooperation and utilization of Russian and Chinese space assets. Um, this one in particular Dr. Stone utilizes a Russian craft to go to the Chinese space station. No one was alive at either one. She's definitely by herself. But I found that interesting and I wonder if the same, the same thought would be there ten years later in cooperation with these other countries.

Shiva Goel

Yeah, that's a great point. You know, ah certain certainly cooperation continues in space. Even between rivals where you wouldn't expect anything to happen. But, but we are seeing, you know, greater risks with the weaponization of space. We are seeing, obviously, a very large ah country with an established history in Space doing a bunch of horrible things that we don't like down here on the ground. And I think you're right, right? Like if this movie is made in 2023 it's gonna look...There's maybe going to be pressure on the narrative that that you didn't see back then.

Henry Gola

Yeah, for sure. So, I want to make an admission that ah, this was the first time I saw this movie. I was aware of its concepts but it came out in 2013 which, due to that also being the year my twin girls were born, is sort of like a 2 year - starts a 2 year pop culture black hole for me. So, I say that because, you know, I haven't read articles or fan theories or anything like that. I came in really fresh to the movie. So, with that in mind, you know, my theory is that the entire movie is a dream sequence for Dr. Stone that sort of tracks her through the grief and eventual acceptance of the death of her 4-year-old daughter. What do you think? Is my - am I completely off? Is this actually a space movie or...?



Shiva Goel

I am, I am a much more literal person than you. You know, very clearly that did not, that did not cross my mind at all. In fact, you know there is a part of the movie where Kowalski disappears and then he reappears at a time where, you know, in Dr. Stone's psychology she really needs a boost. And when that first happened, I think probably 99% of the viewing audience was like "Oh, this is a hallucination." He's clearly not there in real life and, you know, was like "Oh my gosh, he's back!" So, I love that theory. It's good to sort of ah read things into movies that may have not been intended. Part of what I really liked that, kind of on that score, was you know how they shot the movie. And I had done some reading about this where, you know, Sandra Bullock and George Clooney spend half the movie spitting around at varying rate to speed.

Henry Gola

Right.

Shiva Goel

And, you know, obviously it is quite hard to do that with actors. So, they ended up moving the cameras or sort of doing a little bit of both. And you know, surely that was a convenience, and a cost, and a sort of risk-based decision. But it was also sort of a good reminder that when you're talking about space, you know, relative motion is what we perceive and that ends up being super important with satellites and all sorts of things in space.

Henry Gola

Of course, of course. Yeah and they had to do it in a way where you felt the motion of the astronauts but you weren't making the audience sick, right? You really need to thread the needle there, which I think is a lot. You know it's easy for me and you to say that, but I bet was a big challenge for the director and the cinematographer and the special effects folks, all of whom won Academy awards. And deservedly so.

Shiva Goel

I mean it holds up, right? Things were pretty advanced in filmmaking in 2013, but yeah, sometimes when you watch a movie that's more than 10 years old, or about 10 years old, you know, you're kind of reminded how far special effects and filmmaking have gone. And that really wasn't the case with this. It holds up so well.

Henry Gola

Oh yeah, it definitely held up. And it's probably, you know, it's probably the time and investment. I saw today when I was, you know, looking on IMDB to recite the background, that the special effects took three years to do. All the background shots of earth and space. So that's a, that's a big chunk. And I think, you know, maybe not all movies that have special effects have such a long lead time nowadays.

Shiva Goel

Yeah. Yeah, now that you're talking about it, I'm almost surprised this ever got, you know, greenlit, right? Like this day and age, some outlet, some studio is going to green light like just about anything but, but like back then there were, there were real standards. And, you know, you're talking about something that happens at a time when perhaps the public consciousness is, as we discussed earlier, not quite tapped into the possibilities in space and yet they did it and they did it very well and they put a ton of money behind it.

Henry Gola

Shiva, anything else to add?

Shiva Goel

No, this was, this was lovely and, you know, great selection. I will admit at the end, this might be the first feature length film that I've actually seen since my second daughter was born 15 months ago. So, I was glad just to have an excuse to watch something here and certainly fun to talk about it with you. So, thanks Henry

Henry Gola

Very very happy to do so. Thanks for joining me, Shiva, I appreciate it.

Shiva Goel

All right. Take care, bye.