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AFJAGS Podcast: Episode 65

Orbital Debris with Major Edwin Kisiel

Host: Captain Charlton Hedden

Guest: Major Edwin Kisiel

In this episode Captain Hedden sits down with Maj Edwin Kisiel to discuss his recent paper, *Law as an Instrument to Solve the Orbital Debris Problem*. Maj Kisiel outlines the current environmental laws and the gaps created by the rapid development of space technology and its resulting debris.

[Music: Band playing clip of Air Force song]

Introduction

Captain Charlton Hedden:

Today we are joined by Major Edwin Kisiel. And I will let him introduce himself as far as his career and his background with this topic and how he came to be interested in solving the orbital debris problem. Over to you sir.

Major Edwin Kisiel:

I am a Air Force JAG. I've been on active duty for over ten years now and my interest in the topic came from several different aspects of my career. I was assigned previously within the space enterprise and then following that I

went to George Washington University as part of the Air Force's L L M program, and I had an opportunity to study space law there. I found it a fascinating subject, and it was right about the time that we were talking about the potential for what's going to happen with the Space Force? Are we going to be looking at it as a unified command like we have with U.S. Space Command? Is it going to be a corps or is it going to be a force?

And then following the L L M program, I had an assignment with the Environmental Law Field Support Center, and I was working for both Air Force clients and Space Force clients on various projects to include launch activities. And I saw an opportunity to apply my environmental law perspective both academically and

practically speaking to the orbital debris issue, because this is a major issue from an operational standpoint. And this summer, I will be taking a new assignment back to Space Systems Command ... to return to the space enterprise. So, it's coming full circle.

Orbital Debris

Capt Hedden:

Great. Yeah, and that interplay between the space law topic and the, I guess, just sort of space reality of orbital debris. And then you're your training in environmental law is what really caught our attention with these the proposals in your in your paper and your presentation. But before I get too far ahead of myself, both of those, the paper that you wrote that was published a couple of years ago and the presentation that you delivered for the Advanced Environmental Law Course recently ... are how you ... how to use law as an instrument to solve the orbital debris problem.

So, before we jump in to propose solutions, talk to me about this orbital debris problem, starting with kind of the basics of what is orbital debris and what's the problem with it.

Maj Kisiel:

Absolutely. So orbital debris is the fancy term for space junk. So, over the last 60 years, we've gone from the basics of exploring space, launching the first satellite to now as of the date of the article, there are about 7500 satellites in orbit. Satellites are getting smaller, orbit, especially in low Earth orbit, is getting more congested. We're hearing about for instance, the StarLink constellation, which is launched about 10%. I believe that one is going to be about 1700 satellites. We've got a ... so over time, space has gotten more congested. We've also had collisions by items in space. We've had items left behind from space walks and all of these things that aren't supposed to be there, that aren't serving a purpose ... they are space junk.

And we estimate that there are probably about 130 million pieces of debris, space junk in orbit. And in low Earth orbit things are circling the earth at 18,000 miles an hour. So, you have a lot of items moving very quickly and it can cause substantial damage. So, some of the statistics are a piece of debris that is up to one centimeter in diameter can cause critical damage to disable a satellite. Something that's larger than ten centimeters in diameter can shatter a satellite or spacecraft. And with our current technology, we can only track things and avoid them down to about five centimeters. So, the orbital debris problem is essentially that we have a lot of space junk floating around with the potential to collide with satellite or other spacecraft and not only damage that satellite and also impede its mission, but every time you have a collision, it creates more and more orbital debris.

There was a NASA physicist in the 1970s, Dr. Don Kessler, and he came up with a theory that's called the Kessler Syndrome that essentially if nothing is done about this, you have debris exponentially creating more debris that then you ... cause certain areas within low Earth orbit to be unusable, which means we lose our access to the space domain. And so, if nothing is done about this, we have the military implications of not being able to carry out communications, satellite observation and then position, navigation, timing, all these sort of things.

And then from a civil society standpoint with, you know ... today modern society is reliant on G P S, on satellite communications. A lot of people subscribe to satellite radio. We have internet. And so, if you lose access to certain regions of space where these services can no longer be provided to civil society anymore, yet we're so reliant on them that then you kind of get into some apocalyptic scenarios.

And the problem with orbital debris is that it stays around for a very long time. And so, once the problem gets to a point where it's uncontrollable, then we're

really sunk. So that's the orbital debris problem and why it's important and why we need to do something about it before it gets out of hand.

Clean Up

Capt Hedden:

Yeah. Well, it does sound like it could cause some pretty significant problems, which is probably why there are various organizations working on ways to clean it up practically to send something into space that can remove the debris. Right? I know that's not that's not the main thrust of your scholarship, but you did end up learning a good bit about where those technologies are right now. So, can you kind of tell us practically how this might look that an organization, be it a government or a private company, could clean some of this up?

Maj Kisiel:

Certainly. So, there are a couple of different ways to look at it. So, you can look at it from the debris removal standpoint. And you can look at it from the debris prevention standpoint. And so, the debris removal standpoint, there are several different efforts underway within universities in the United States as well as in Europe. The European Space Agency has a project, China has a project. And a lot of and the idea behind these are you have satellites ... they can come in various sizes. Some are larger than others, and they can use grappling arms, they can use nets, they can use tethers to basically gather up debris in orbit. And then they either will take it down into the atmosphere to burn up or kick it out to what's called a graveyard orbit, which is out of the way of everything that's an active satellite in low Earth orbit.

So those are the technical solutions in play from a debris removal standpoint. The other thing are from a debris prevention standpoint. And so, there's a company in El Segundo, Millennium's Space Systems, has developed this concept of the Terminator Tape. And essentially, when a satellite reaches the end of its useful life, it deploys this ribbon that acts as a sail to create drag and then bring the satellite down to burn up in the atmosphere.

So, there are certain concepts like that, that are being looked at as well. So, we'll probably see some more developments from a technical standpoint over the next few years. The main thing I'm looking at is, you know, the technical solutions are evolving. So, we need the legal concepts, to take care of this issue, be developed as well.

Space Law

Capt Hedden:

Right. Exactly. So, the technical stuff aside, your research and writing has focused on how can we use the law to start fixing this problem. Which kind of begs one question that is, okay, well, what law is there now and why is it insufficient?

So, can you kind of give us an outline of what laws do apply in space right now? And why aren't those working well enough to fix this?

Maj Kisiel:

So, there are ... first of all, there are a few international treaties that form the bedrock of space law. And there are some provisions that address this issue. And then we look at ... in the U.S., there are domestic launch licensing requirements in other nations in the European Space Agency have some provisions like this as well. So first I'll talk about the international treaty.

So, we have the Outer Space Treaty, was formed back in 1967. This is a widely accepted treaty. We have 133 nations that have signed on to it. The Outer Space Treaty, Article Nine contains several different provisions. For instance, nations conducting activities in space need to go about their business with due regard to the corresponding interests of other space faring parties. They need to conduct exploration of space so as to avoid harmful contamination. And then if you have one country not doing what they should be doing, then there is consultation provided as a remedy.

Article Eight of the Outer Space Treaty talks about liability that each nation is internationally liable for damage to another nation or entity ... that country's

space objects or components of space objects which would cover orbital debris. So there's these two articles in the Outer Space Treaty that talk about ... that could talk about this issue.

However, the problem with the Outer Space Treaty is that the language is aspirational. You don't have an enforcement mechanism behind it. If you were to have one country allege that another country is violating the treaty, the International Court of Justice is your forum to render decisions on treaty violations. However, they only provide an opinion. They cannot enforce their decisions. It goes to the U N Security Council, who has enforcement ability. However, if you try to and as we're seeing unfold in the Ukraine situation, for instance, if you try to enforce an International Court of Justice decision, you can't enforce it against a Security Council member such as Russia or China that has veto power. So, in essence, violations of the Outer Space Treaty are not enforceable.

Some interesting things to note, are that Article Eight does provide a reasonable liability standard. Now, as I mentioned, this was developed before the commercialization of space. So, we look at the government parties as responsible for the activities of corporate entities within, operating within that country. And then the responsibility for activity in space falls on the ... either the country responsible for the launch or for procuring the launch of the space object, if you will.

That's the Outer Space Treaty and then we have the Liability Convention, came about a few years later. So that turns 50 this year. And the Liability Convention has been signed on and accepted by 121 countries. And there are two standards of liability that we see in the Liability Convention.

So, Article Three, we have the negligence standard for damages in space, and that is a tort negligence standard. So, in the event of damage caused elsewhere than on the Earth to a space object of a launching state or persons on board the space object, the launching state

is liable only if the damage is due to its fault or the fault of persons for whom it's responsible. This raises as your standard tort negligence analysis.

But you do have in terms of a, you know, looking at interpreting this provision from the perspective of different countries, you can have the potential for a different result if it's analyzed under our English common law system or a continental civil law tort standard. And so, your duty of care can be established through ... we do have orbital debris mitigation standards that are published by the U N Office of Outer Space Affairs, as well as several different countries.

So, you have evidence of that, that can act as a standard of practice within the space industry. However, a lot of these orbital debris mitigation standards, actually, all of them are expressly non-binding. So that can create an issue when you're trying to prove whether or not there there's a specific duty for a specific orbital debris mitigation requirement. And then you have issue in terms of quantifying damages.

So, under the Liability Convention, you have liability or compensatory damages such as the destruction of property from collision, loss of use of a satellite. However, there is no liability provided for what I will term the environmental damage, that is the cost to remediate the orbital debris cloud that was created by that collision. So, while the party whose satellite was harmed by the negligence of another can recover for the damage they directly sustained, there's no way to ... no mechanism here to require payment for the damage caused to the space environment by ... now, we have tens of thousands of new pieces of orbital debris that need to be cleaned up.

Some other issues with the Liability Convention are ... so if you have a commercial satellite that was destroyed in a collision and they're seeking compensation for that, that company has to go to its national government to assert a claim under the Liability Convention. And you could have an issue because of the way multinational

corporations operate, where the satellite that caused the damage may be owned by a company that's in a different country than the responsible launching state, where the only relationship between the company at fault and the responsible launching state is the fact that that's where the satellite was launched. So, you can have issues of trying to bring the responsible party, the ultimate responsible party into a claim and then the Liability Convention doesn't guarantee that an actual party at fault will even ever be responsible for damages. So, you have jurisdictional issues that I talked about.

And then there's the other big issue you have here is that there's no actual enforcement mechanism. The Liability Convention provides for a claims commission to convene to hear the evidence and make a fault determination. However, the decision by the claims commission is specifically a recommendatory award. So, it's not binding on any party unless those parties have expressly consented to a binding award and why would they, if they're the one at fault? So that's another big issue with the Liability Convention.

So, then we look at, well, is there customary international law that could play a part here? And unfortunately, we're not there yet because as I mentioned before, the current orbital debris mitigation standards are expressly non-binding. So, we don't have the widespread adoption, compliance or legal enforcement that we need in order to establish debris mitigation standards as a matter of customary international law. The closest that we can get at this point is probably an environmental law concept known as the precautionary principle. Which means that nations should avoid taking action resulting in environmental harm without balancing the risks of harm against the benefits of the action in adopting mitigation measures. So that's about as close as we get with customary international law, which is to say not very close [laughing].

Launch Licensing Requirements

Capt Hedden:

So, what about ... I understand there is there's right now there are some requirements placed on entities that want to launch things into space. And that ... and those requirements right now, they kind of, they control some behavior on the, on the part of those launching parties. But those, I take it, are not right now in a place where they would start solving this. Can you tell us about those?

Maj Kisiel:

Certainly. So, you do have within the United States, within Europe, and other countries, you have launch licensing requirements. And so, in the United States, for instance, a launching entity has to agree to certain orbital debris mitigation practices in order to get their launch license. And so, you have a launch license. You have, if it's a communication satellite using bandwidth, you have the Federal Communications Commission operators permit. You could have for like a weather satellite; it could be a NOAA permit.

So, there are certain, there are certain domestic requirements from law and regulation that can be placed on satellite launch entities and operators within the United States. But the main issue you're going to run into here is inconsistency. So, while an American company is held to one standard, an European company will be held to a, albeit similar but slightly different standard. But then when you look at China, they're not going to have the same level of debris mitigation commitments that you see. And so, you have inconsistent requirements across different space actors, and there's no international enforcement mechanism. If one person is not following the set of rules that they're supposed to.

Superfund Statue

Capt Hedden:

Gotcha. So you've use the term enforcement mechanism a whole lot when you're discussing what currently exists. So it sounds like what rules there are, are virtually impossible to actually enforce. So, they're

not really changing any behavior at the moment. So as of right now, the space problem remains kind of unsolved, at least from a law and policy standpoint. So what kind of proposals did you come up with that the law could address to just start things heading in the right direction here?

Maj Kisiel:

So, my main proposal is looking at the American concept of the Superfund statute. It's the Comprehensive Environmental Response Compensation Liability Act. And this is a statute that applies to clean-up of industrial waste contamination within the United States. And I'll get to that in a moment. But some of the other proposals that I thought about, like to do some further research into. So the development of new treaties ... probably not likely at this point. We don't have an international appetite for overhaul of the Outer Space Treaty or creation of any new treaties. I think that current events in the world show that countries are more diverging from one another rather than seeking to cooperate. What you could see are trade agreement rules where like-minded nations can enter into trade agreements to try to establish customary international law and then international commercial arbitration is ... in terms of enforcement that would be the ideal mechanism here, because it's flexible. Your venue can be anywhere in the world. You can choose the parties to arbitrate, can choose the law that will apply. Most arbitration is done under English law. They can adapt rules based on the needs of the hearing, for instance, the Permanent Court of Arbitration has provided a set of draft rules that parties can use for disputes in outer space. And there are ... within the space arena, there are a couple of conventions or a couple of different organizations that have adopted international commercial arbitration for resolving disputes already. And so, what I would do is pair that with the ... a Superfund type statute for space.

And so, with the Superfund statute, the federal government created a trust fund and that trust fund was initially created or funded by taxes on petroleum and chemical companies. And the government can use that

fund to when you have industrial waste contamination, the government can orchestrate a clean-up response and a restoration response to that site and then sort out the liability among potentially responsible parties for creating that contamination.

So on the back end, the Superfund gets reimbursed for the response cost from the responsible parties. So, when you're looking at liability under the Superfund, you have a broad definition of liable parties. So this is anyone who's owned or operated a particular site that's being cleaned up. Hazardous substance disposal facility from that site or arrangers or transporters of hazardous substances to or from that site. They can all be potentially responsible under a scheme of joint and several liability for cleanup costs.

Additionally, the Superfund has broad reach in terms of retroactive liability. So, if the government is undertaking cleanup of a site where the contamination was created prior to the enactment of the Superfund statute then those parties are still responsible. And so, it's up to the parties to sort out among themselves who is most at fault and contribute to the reimbursement of the trust fund accordingly.

Capt Hedden:

So in theory, hypothetically, this might look like some kind of collision creating debris and some international organization being able to initiate and fund the cleanup of that debris without regard in the short term to who actually caused it or would ultimately be liable and then seek reimbursement into that Superfund from whoever is determined to be a liable party. Is that about it?

Maj Kisiel:

Yes. That's the gist of the idea. So, a Superfund analog for space would enable the cleanup body to recover the cost of the debris remediation from the parties at fault. In some circumstances, it may be difficult to prove who is liable, especially when you're looking at smaller pieces of debris that we don't know necessarily where all of those originated.

But another thing, and what you see with the Superfund statue in the United States is that it causes industry that may potentially create, you know, industrial waste contamination to purchase insurance in the event that a cleanup is required and they are potentially at fault. You have an insurance forum that would reimburse those costs and cover any liability on the part of the companies.

So, you could see potentially orbital debris mitigation insurance developed if we have this kind of system in space. Because the current insurance requirements are that you have to maintain insurance for the launch plus the first 30 days of operation. And this ... if you end up having or developing a liability scheme that covers the satellite's entire life cycle and then some if it's a defunct satellite that's still up there then it would create a requirement for satellite owners and operators to either obtain insurance to cover the collision risk or to just self-insure understanding the liability that comes with that.

And then if you paired something like this with international commercial arbitration, where satellite owners and operators have ... are required to agree to arbitration, claims against them in order to obtain a launch license. And that was an idea that comes from Professor Henry Hertzfeld. He's the space law professor at George Washington University. You could really start with a U.S. based effort that applies to launch entities within the U.S. and then if other nations decide to sign on to this, well then all of a sudden you have a binding international arbitration system between the countries that have agreed ... that are requiring that of ... satellite owners and operators within those countries.

Capt Hedden:

And then conceivably flowing out from that, you could end up with customary international law so that even somebody who hadn't affirmatively agreed to abide by those might be forced to. Right?

Maj Kisiel:

That's correct, yeah.

That would be ... the ultimate idea is, you know, you create binding orbital debris mitigation standards.

Making It Enforceable

Capt Hedden:

So I got to think that there are some criticisms of how these systems work, whether the proposal to apply them to space or even just how they work now. So what are some of the gaps that might need to be shorn up if we were to use this kind of circular model plus arbitration that you see from where you sit now?

Maj Kisiel:

So if you have the liability response system, you really need a mandatory preventative measures to be truly effective. So orbital debris mitigation standards need to become expressly binding in order to be truly effective. I will say that, you know, the vast majority of operators in space follow the rules, but you do have a few who don't. And for, for instance, in 2007, China launched an anti-satellite missile test that created a huge cloud of orbital debris and it's dispersed all over low-Earth orbit. So you have some actors that these things aren't binding. They're not going to follow them. They're going to do what suits their wishes.

And then the main shortcoming to, or the main obstacle to my proposal is, okay, how do you take this and make it truly effective? And so, it's, it would be a long process of, you know, as Professor Hertzfeld suggested, you have to start it probably with ... as a domestic initiative applying to launch entities within the U.S. or another country that is interested in doing this. And so, at that at that point, it's not quite enforceable because you don't have anyone else on the other side agreeing to arbitrate. So then it's kind of it would require a snowball effect for others to decide this is a good thing and we're going to do this for companies launching from our country. Before ... so it would take a while to create a binding international scheme. Because frankly, there's no there's

no appetite to address this through a treaty right now. So it's certainly an issue of making it enforceable and getting enough folks to sign on, so it would become customary international law for those who don't want to participate.

Closing Thoughts

Capt Hedden:

Yeah, it does sound like it sounds like it needs to it's to kind of start small and grow, which I guess is an issue because all during that time there are at least the potential for continuous amounts of debris to be created out there. So that's fascinating. Is there anything else you'd like to leave us with before we wrap up, sir?

Maj Kisiel:

So some other interesting things that are happening right now is within the realm of the National Environmental Policy Act, which requires the federal government to analyze the environmental impact of any major federal action, such as issuing a permit. And, so the human environment is currently considered a terrestrial concept but when we're looking at, for instance, in the Air Force of actions changing the boundaries of airspace, the F A A and the Department of the Air Force, look at those airspace changes as environmental effects. So, could we consider human inhabited space ... such as the International Space Station's orbit, to be part of the human environment?

There's a current case that I want to point out, and this is ViaSat, which is a satellite internet provider operating in geosynchronous orbit versus the F C C. And they were challenging the F C C grant of an operators permit to Starlink, alleging that because of the vast number of Starlink satellites, being launched, the F C C should have done environmental analysis on that because of the potential for nighttime light pollution by this large Starlink constellation. So, the Federal Communications Commission applied a categorical exclusion from analysis to the Starlink permit because it's a commercial satellite project. So that is pending litigation that we'll

see how that resolves in the next couple of years. But the National Environmental Policy Act could be another interesting area to watch when it comes to permits for companies to operate in space.

Capt Hedden:

So if that sort of NEPA involvement does become more required for anything that requires a permit, how would how could that look ... what could it look like, say, if the F C C loses and the court says now you should have done what ViaSat is claiming you should have done? How could that look in the future? And what would it change about the possibility of debris mitigation?

Maj Kisiel:

So immediately in that case, if it goes the direction of ViaSat, then the F C C would have to go back and do environmental analysis of the Starlink constellation, as to the specific issue raised of the size of the satellite constellation and creating light pollution at night.

However, if you have some regulatory or statutory changes made to NEPA then, you could start to see orbital debris creation and mitigation as an issue that would have to be analyzed in terms of launch and operating permits. So that could be yet another way to impose mitigation standards. I don't know if they would really get much farther, though, in terms of American companies that are launching or operating satellites in space because of the licensing requirements that are already in place.

Capt Hedden:

Gotcha. So this wouldn't necessarily be a big step toward global cooperation for mitigating it?

Maj Kisiel:

No, no. We really need, you know, we really need some kind of global ... we would need some kind of international system that could coordinate the debris remediation response to collisions and a way to enforce liability for the costs incurred from cleanup.

Capt Hedden:

Gotcha. And with that, sir, what parting thoughts do you have on here? We really appreciate your coming on and talking to us about this orbital debris problem, where it's kind of going and how it happened and what can be done about it and how and more importantly, how we can bring the law to bear to start solving it. So on top of all of that, really great information, what else do you got for us, sir?

Maj Kisiel:

So parting thought I have is looking at, you know, why is this important? And from an operational perspective, when you're looking at, for instance, the Predators and the Reaper aircraft that the Air Force operates, and in order to carry out, for those aircraft to carry out their mission and engage in reconnaissance or put bombs on target they need to be able to use a satellite to communicate with the ground station that's controlling the aircraft.

If that satellite for some reason can't operate in a certain area or gets taken out because of a debris cloud, or collision with another satellite, then you have an issue where that aircraft is taken offline and it can't accomplish its mission. So, in order to for the Air Force to carry out its mission on Earth, we need to make sure that we have access to the space domain so that our satellites that we need can operate. And so that that's the importance that this issue has from an operational perspective.

Capt Hedden:

And that sounds pretty crucial.

Maj Kisiel:

Yes, absolutely. I definitely enjoyed researching in this area and I do look forward to continuing to look at ways to apply an environmental law perspective to space issues. And I want to thank you, Captain Hedden, for your time today and for The JAG School for hosting this podcast. Appreciate it.

Wrap Up

Capt Hedden:

Yeah, thank you, sir. We appreciate you stopping by.

[Music: Band playing clip of Air Force song]

Announcer:

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Glossary

- **FAA:** Federal Aviation Administration
- **FCC:** Federal Communications Commission
- **GPS:** Global Positioning System
- **JAG:** Judge Advocate General
- **LL.M.:** Masters of Laws
- **NEPA:** National Environmental Policy Act
- **NASA:** National Aeronautics and Space Administration
- **NOAA:** National Oceanic & Atmospheric Administration
- **UN:** United Nations

Websites

- [Comprehensive Environmental Response, Compensation, and Liability Act](#)
- [Kessler Syndrome](#)
- [National Aeronautics and Space Administration](#)
- [National Environmental Policy Act](#)
- [Outer Space Treaty](#)
- [Space Force](#)

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