This transcript was exported on Mar 31, 2022 - view latest version here.
Orbital Debris Clean Up Your Space
Transcript by Rev.com
Page 1 of 11
Paul Thies:
Ever since the space age began in the 1950s, manmade objects have been filling the nighttime sky in an
increasing number, but what happens to all those rockets and components floating around our world?
Though some burn up in reentry, an ever-growing number of artificial objects litter the stratosphere
presenting potential dangers to astronauts and costly damages to satellites and spacecraft.
Paul Thies:
Hello, I'm your host Paul Thies. And in this episode of If/When I explored the topic of orbital debris with
Dr. Phillip Anz-Meador, orbital debris principal scientist, Jacobs JETS Contract Group. In the discussion
that follows, we talked about the size and scope of the problem of orbital debris, the safety hazards it
presents and what is being done to remediate the problem. Well, Phillip, thank you so much for joining
me today. It's a really fascinating topic, this topic of orbital debris, and I'm really looking to diving into it
with you. So thank you for joining me.
Phillip Anz-Meador:
My pleasure. Thank you for inviting me.
Paul Thies:
Yeah, absolutely. To start us off, can you just tell us a little bit, basically, what is orbital debris?
Phillip Anz-Meador:
In the simplest sense, it's anything that has ceased to have provided a useful funcg��　f怀㖀 sr���喅鐁Ȁulpless 怀㖀�9؁ᨀor: and W←ᤀuch tho灴↖�e be՘奀ᄀome ᘀ�orbital debris, as �tࠁ漀l. In fact, the ᘀ�oldest tॠ鎀ᖠing0᝗脁딀l eartd orbit right ow, vatellite catalo灴↖� objeD쀀ct number W←ኀive 戀�is an堀� earlကy ڀ͐�D W←ᤀpacecrafကt hat's Ǻeen there瀀耀〇䈙since 1࠵鎀㽐59, I believe. And it's
Po灴↖퀀ng to Ǻe there W←ኀor proba鈀�bly housands of years more. Pհaul Thies: Phillip Anz-Meador: њo՘奀ဠuęꀀ was��՘夃頀�s one of he ǭarly Explorer 攀�serie砀�s W←ኀlights or 攀�܃΃⠓anguards 戀�if recall correctကly. Paul Thies: o̓甀0orbital debris, though, tကo kind of et a sense of the瀀耀〇䈙scote ofက the瀀耀〇䈙problem՘奀ဠut's Ūot juΐ扐ᤀt spacpr�ᄀraft though, right?ƀ0݂ᤀ⼀ mean՘奀ဠus it satellҒᢀᗐte arts?ƀ0݂ᤀЀnd՘奀ဠ ᘀ�mean՘奀ဠĜကhen you think abကout all the things W←ᦠhat we��̀p constantly launching into space: ele՘奀ᄀommunicat䈙fns sat䔀�ellҒᢀᗐtes, nd W←ᦠhis Ĺإad W←ᦠhat䔀�՘奀ဠ W←ᝐean՘奀ဠđ�an you speaကk to the siҒᢀ᳀e and scote of he problem?

This transcript was exported on Mar 31, 2022 - view latest version here.
Orbital Debris Clean Up Your Space
Transcript by Rev.com
Page 2 of 11
Yeah, no. You're absolutely right there in the sense that all of the objects I've named so far are
essentially intact, right? They may have expended fuel or things like that, but they're essentially in one
piece, the same piece that was launched initially. Kind of more pernicious is fragmentation debris, and
that's really kind of where I've devoted a lot of my career to studying. And all good things have wiring
diagrams or flow charts associated with them, so in the case of fragmentation debris, you can really talk
about breakup debris, which is where things explode or collide. And then what we term anomalous
debris, cause it's produced, we don't understand really the production mechanism of it, but nonetheless
it's there.
Paul Thies:
And so, with this stuff floating around, I mean, it kind of seems like, so you put satellites up there, for
the functioning of... particularly in the digital world. I'm curious, with all that debris, how we keep it
from interfering with things that we want to be in orbit versus all this just space junk, for lack of a better
word.
Phillip Anz-Meador:
�zZU�•šoÇX��v�šZš–•�v�Æo’%À}µvoo��}vÀ�XY@�š���2•š�p
�WŒ� �coP���šZ�•` ��

This transcript was exported on Mar 31, 2022 - view latest version here.
Orbital Debris Clean Up Your Space
Transcript by Rev.com
Page 3 of 11
However, there are things below the size threshold of the catalog and cataloging itself is very difficult.

This transcript was exported on Mar 31, 2022 - view latest version here.
Orbital Debris Clean Up Your Space
Transcript by Rev.com
Page 5 of 11
what McDonnell Douglas in concert with NASA and the DOD did at the time. And they introduced these
relatively simple mitigation measures to prevent breakups in the first place.
Phillip Anz-Meador:
Now, you had asked about how long this has been a problem. So, essentially, the first breakup was in
1961 and there were subsequent breakups over time. But one of the things that was noted, if we keep
track of these things, is that that rate of increase was much larger than the rate of increase of payloads
or rockets or things like that. So after 1961, it became the majority component of the population and it
was increasing faster than the general population, the attack population, so to speak. So remember Don,
he was looking at all these numbers of things being produced and spoke with McDonnell Douglas. They
introduced some relatively simple mitigation strategies and kind of by the mid-eighties, those really
started to pay off. The number breakups decreased. As a result, it put a kink in that slope, so you
weren't creating these objects as fast anymore, and you kind of started to level off in that debris
production.
Phillip Anz-Meador:
It seemed great, for a time. And I've kind of, at least personally, come to think of this as the age of
mitigation. So not making a mess in the first place. Unfortunately, the age of mitigation did wonders for
flattening the curve in the growth rate of debris. However, it has not lasted. And the modern age has
become dominated by a couple of significant events. And really the first of those was a test of what's
called an anti-satellite weapon, or an ASAT, conducted by the People's Republic of China against one of
their derelict low Earth orbit weather satellites in January of 2007. That was a very bad day. In the
course of that test, over 3,500 trackable Ą鈘耗怀g athIĲ脁紀Ź㥀ᣀœ3,500	e Ą鈘耗怀e nttiplefbad \
I候ꀀ seemed ࠧↀp�ᣀceac怕持Ḁ rng st傖सi at te �gni�喠ecanteřꀀ t㤆━谀gs �aeaAdllyrelŠid.Š������퀀nĀ�dlly3,5̀n Ɠ遢倘쀀ᔀ irrǉꀀ oary trҠ:kǰighvr ʁeemed ࡅ瘀ᥠ鎀ᚈe倁馠eevr　 � to ra܃቙ↈaoƀဠi

This transcript was exported on Mar 31, 2022 - view latest version here.

This transcript was exported on Mar 31, 2022 - view latest version here.

O莘䐀䬀is ttt̀�냱ᖖ需菱ቹ馐M

This transcript was exported on Mar 31, 2022 - view latest version here.

Orbital Debris Cl ean Up Your Space

Transcript by Rev.com

This transcript was exported on Mar 31, 2022 - view latest version here.

Orbital Debris Clean Up Your Space
Transcript by Rev.com
Page 9 of 11

nature. And so, it became clear that orbital debris is not just an orbital problem, but rather it can reenter
the Earth's atmosphere in an uncontrolled fashion, land on the ground, and either the pieces that
survive, or at least in one case the concern over a fuel tank that would've survived to the ground and
had toxic propellants in it has posed some risk to the ground population.
Phillip Anz-Meador:
And, in fact, some of the tools that Jacobs and our consortium teammates under the JETS contractor at
JSC have facilitated the development of look exactly at that. So, essentially, they begin with a model of
the spacecraft or the materials identified, what materials burn up in the upper atmosphere, which
survive down to lower altitudes, or can even strike the ground. And one of the outputs of that effort is
what's termed the casualty area and kind of the casualty probability associated with it. For example, in
the last century, due to mankind's activities, humankind's activities, it was noted that about 15 joules,
where joule is just, of course, the metric unit of energy, is kind of the threshold for casualty and such.
And so, our models can use that as a threshold. It can look at the population density on the surface of
the Earth, of course, 70% water, but certainly there are many population concentrations.
Phillip Anz-Meador:
For example, the Ganges Valley of Northern India is the most densely populated spot on earth. And
then, we can essentially fly our reentering spacecraft over the Earth. We can update it with new orbital
measurements from that space surveillance network and such, and we can then estimate the risk that's
posed to the ground population by these reentering objects. Also, we can help out space designers from
the get-go cause we can make recommendations of not using materials that will survive reentry, but
rather there's a whole design paradigm now, it's called Design for Demise, and it's exactly what it sounds
like. If you can design your spacecraft to fulfill its function, maybe using modern materials, such as
composites and things like that will demise on reentry, absolutely fantastic. And it can become a design
goal.
Paul Thies:
It sounds pretty innovative. Is that widely adopted or is it still kind of in the early days of adoption? How
Phillip Anz-Meador:㈀� calole 　Design foBꀀ

This transcript was exported on Mar 31, 2022 - view latest version here.
Orbital Debris Clean Up Your Space
Transcript by Rev.com
Page 11 of 11
Phillip Anz-Meador:
The next part are the liabilities and such associated with doing some sort of remediation, because let's
suppose that your chosen tool of remediation is a harpoon. Okay? What could possibly go wrong? Well,
some of the things that could possibly go wrong are vessels that still maintain pressures of, for example,
hypergolic propellants or other sorts of pressurants that are common on many spacecraft and rocket
bodies and such. And what would happen if your harpoon accidentally struck one of those? Well, that
would not be a good day. And so, just as doctors may have the credo of, "Do no harm," well, we should
probably do no harm to the [inaudible 00:38:00] environment in trying to make it better. Kind of the last
challenge or direction of development that needs to be considered is that dealing with the diplomatic or
international relations realm, and how do we behave in space? Things like rules of the road or a
common set of behavioral norms is something that's appeared with increasing frequency over the
course of the last couple years.
Phillip Anz-Meador:
One of the other terms you'll hear used a lot is the concept of space as a domain. And in this sense, that
was one of the rationales for when we stood up the US Space Force, because it was responding to
perceived needs in a domain. And that domain just happens to be space. In that sense, it is equivalent to
say the terrestrial domain with the Army and the Marines, the maritime domain with Navy and Coast
Guard and the atmospheric domain with the Air Force and such. So it's kind of an interesting take on the
environment kind of segueing, perhaps, from a late fifties, early sixties view of space as this infinite
space that the starships of science fiction goes zipping through to very much more of a populated space
and a finite resource. And that's very true both for some orbits now in low Earth orbit, in other words,
top of atmosphere up to about 2,000 kilometers altitude, as well as the geosynchronous belt. Overall,
kind of the mental shift is every bit as important as some of the technological aspects that we've talked
about today.
Paul Thies:
Oh, that's pretty fascinating. I think with that mental shift, the people will recognize the problems
attendant to orbital debris, and then there'll be greater emphasis and hopefully greater resources
applied to that and in the mitigating and remediating those. Well, Phillip, I really appreciate it. This has
been very fascinating and, I mean, you've really painted a picture for me and for our audience. I really
appreciate all the information and I appreciate your time today.
Phillip Anz-Meador:
Hey, my pleasure, Paul.