

==Transcript of Zoom Chat between Participants==
Losing The Sky Event, June 15th 2021
<https://www.youtube.com/watch?v=ESoM3Noz5zk>

19:41:41 From Jonathan McDowell to Everyone : 541 watching on youtube right now

19:50:39 From Andy Lawrence to Everyone:

Qs from participants?

19:51:15 From Meredith Rawls to Everyone:

YouTube is delightfully chatty and there are questions interspersed in the live chat

FWIW

19:51:23 From ASE Will Joy to Everyone:

Comment from John Murrell, ASE member on YouTube: For large professional telescopes, the satellites are not in focus, so you get a broad undefined streak, greatly impacting images.

19:51:52 From Stuart Eves to Everyone:

Even if we manage to limit satellite's optical and RF signatures, will they still be a problem for IR astronomy?

19:52:02 From Catherine Heymans to Everyone:

Q&A What if we sent all our telescopes into space, or to the moon - would that work if we could find the resources?

19:53:11 From ASE Will Joy to Everyone:

Dhwani Vaniln't :the issue of brightness of the satellite taken care of when they planned to paint the satellites black ?

19:53:37 From Andy Lawrence to Everyone:

I like that question Will

19:53:43 From Simon Garrington to Everyone:

a) Can you say something about why the part of the radio spectrum that the satellites will transmit in is scientifically important? Is that in use already/how will the sky change in that part of the spectrum? Is this a narrow slice of spectrum or a broad band?

19:54:45 From Andy Lawrence to Everyone:

time for Qs...

19:55:10 From ASE Will Joy to Everyone:

Michael Peel: A project I work on observes at the same frequencies that Starlink et al. transmit at - it's going to be a bit of a problem! Even though we're in a remote site...

19:55:40 From ASE Will Joy to Everyone:

Eliza LeitchHow does the panel reconcile that in remote areas across the world - specifically in Canada - people do not have access to internet without new satellite internet?

19:56:00 From Aaron Boley to Everyone:

L2 will be full of satellites for supporting lunar operations as well

19:56:11 From Nicholas Ross to Everyone:

China are building a space telescope???

19:56:52 From Catherine Heymans to Everyone:

@NicRoss - it's going to be gorgeous: <https://www.sciencetimes.com/articles/30782/20210421/chinas-new-space-telescope-300-times-greater-field-view-hubble.htm>

19:58:49 From Jonathan McDowell to Everyone:

Actually more like 2-3 months in the ascent phase

19:59:05 From Meredith Rawls to Everyone:

depends on parking orbit or not doesn't it? thought it was timescale of ~weeks

20:00:05 From Brian Weeden to Everyone:

with near continual launches, orbit raising, and orbit lowering to refresh and deorbit multiple constellations...

20:02:08 From Jonathan McDowell to Everyone:

Meredith - for a typical set of 60, 40 are let to plane drift at an intermediate altitude for a month or two

20:02:32 From ASE Will Joy to Everyone:
Koen Kuijken: Is Earth observation from satellites also affected badly?

20:10:24 From ASE Will Joy to Everyone:
Lucianne Walkowicz@Sarah White the other issue is local development: if the internet is provided by Starlink, the majority of the money goes into a US company-- no plan I have seen involves local jobs/skill development

20:10:33 From ian smith to Everyone:
low latency applications - gaming?

20:12:12 From Andy Lawrence to Everyone:
My Q: how MANY do you really need

20:12:12 From Simon Garrington to Everyone:
finance ... high frequency trading

20:12:26 From Andy Lawrence to Everyone:
need!

20:13:22 From ASE Will Joy to Everyone:
Eliza Leitch In Northern Ontario, just 3 hours north of Toronto, you are only able to purchase up to 500MB of data with no option for more for roughly \$150/month. Space junk sucks but internet is essential in 2021

20:14:02 From Andy Lawrence to Everyone:
Q: isn't the real problem for ordinary people bandwidth, not latency?

20:14:20 From Amy Mehlman to Everyone:
Yes

20:14:39 From Andy Lawrence to Everyone:
time to open to Qs...

20:15:15 From Brian Weeden to Everyone:
latency is also a huge challenge for any kind of virtual meeting (Zoom, Meet, Teams, Skype, etc) if that's the future of work

20:15:28 From ASE Will Joy to Everyone:
Meredith Rawls I'm glad we are talking about not just 1-2 satellite operators, because this is MUCH broader than one company making tech adjustments to mitigate the situation for large observatories

20:15:29 From Samantha Lawler (she/her) to Everyone:
it is true I'm able to connect from rural Canada on a cell network - will require lots of long overdue government investment to provide the level of connectivity I enjoy here in Sask. in the far north (and of course people are happy to jump on a private company that can do it now now)

20:15:49 From Stuart Eves to Everyone:
Q to OneWeb - An Indian businessman bought a large stake in your company - is he "bought into" the need to protect the skies?

20:16:09 From ASE Will Joy to Everyone:
Richard Bottle: Is one reason why you need lots of satellites in order to ensure you can handle capacity, as well as coverage?

20:17:25 From ASE Will Joy to Everyone:
Jon Frame: Why not have an international one up one down policy that works like carbon off-setting? If a company want to launch a number of satellites they have to pay other satellite owners to bring down theirs

20:17:39 From Andy Lawrence to Everyone:
Lots of good YT questions

20:17:51 From Katherine Courtney to Everyone:
What do the panel think is getting in the way of agreeing internationally binding rules? Surely, operators also want to achieve a safe operating environment?

20:17:59 From Michael Kramer to Everyone:
Information access is important. But do we want to rely on internet access on a few satellite companies? Don't we need alternatives anyway?

20:19:20 From Aaron Boley to Everyone:

Consumer electronic model as applied to space will have many unintended consequences.

20:19:49 From ASE Will Joy to Everyone:

Jonathan CodeNeeds regulation - we are talking about the Commons here - and once again there are land grabs (space grabs in this case) for the commons and most people are left out of the decisions to taken.

20:21:22 From ASE Will Joy to Everyone:

comment above referenced to positional space grab for satellite positions

20:23:32 From Moriba Jah to Everyone:

...we make strides one step at a time with <http://bit.ly/astrigraph> I've yet to see some of the folks here provide space object information into this frame work. See <https://github.com/IBM/arcade>

20:25:12 From Katherine Courtney to Everyone:

I agree with Moriba Jah - without more transparency and sharing of space object data - debris removal solutions won't get "off the launchpad".

20:25:48 From ASE Will Joy to Everyone:

Jane Foz: Why isn't anyone talking to the biologists about the current harm from EMFs?

20:25:48 From Aaron Boley to Everyone:

^with high compliance

20:26:20 From Aaron Boley to Everyone:

Last comment was regarding data sharing

20:27:10 From ASE Will Joy to Everyone:

EMFs question referencing satellite transmissions sent back to remote places on earth.

20:27:14 From stefano gallozzi to Everyone:

we should consider the real number of foreseen satellites which is more than 100thousand, not few tens of thousands.

20:28:34 From ASE Will Joy to Everyone:

Jonathan Code: Very connected to climate change discussions (not) - what is the emission from each satellite launch? And here I am leaving the car and home and taking the bicycle to work

20:30:07 From ASE Will Joy to Everyone:

Sarra FarajWhat happens when all these satellites start getting hacked, weaponized and used against different countries? Connecting the world has also connected the worst of society.

20:32:13 From ASE Will Joy to Everyone:

Nick HowesAnd we haven't even tackled the cyber attack issue yet. & what could happen if a rogue actor took control over a sat and decided to place it somewhere in the pathway of a dead object (hard, for sure)

20:32:59 From stefano gallozzi to Everyone:

more a undefined fraction of satellite's constellation (i.e. starlink) will be devoted for military uses and this violates the peaceful use of outer space.

20:34:30 From Katherine Courtney to Everyone:

How can we engage younger people in this challenge? They can be a powerful voice for change.

20:34:46 From Moriba Jah to Everyone:

I don't think it will be that difficult to define space as an environment. It doesn't depend on biological systems. We can have an environment with abiotic objects and even anthropogenic objects. Marine biologists must now accept that micro plastics are a permanent part of the marine environment. These are anthropogenic objects.

20:35:07 From Aaron Boley to Everyone:

^

20:35:12 From Moriba Jah to Everyone:

Level Up

20:35:40 From Timiebi Aganaba to Everyone:
This is why the Viasat motion is going to be a game changer

20:36:14 From Moriba Jah to Everyone:
It could be... if we have an inclusive dialog and the community comes together to define what the environment is

20:36:46 From Timiebi Aganaba to Everyone:
One of the issues with environmental concern research is that people have not been able to agree on what it is so its a lot to ask

20:37:11 From Moriba Jah to Everyone:
Science will have to be done... that will take funding and support. That's a current vacuum

20:37:21 From Hugh Lewis to Everyone:
Q for Brian: how do you feel about satellites (such as Humanity Star) that aim to encourage humans to contemplate their place in the Universe?

20:37:52 From ASE Will Joy to Everyone:
Fionagh ThomsonTimiebi - is space a domain? that is a military term (claiming land for a specific power)... just as we discuss land rights on earth - we need to discuss how we view and frame a space..

20:37:58 From Moriba Jah to Everyone:
I think empiricism can lead the way

20:38:13 From Moriba Jah to Everyone:
Abductive inference...

20:38:27 From Moriba Jah to Everyone:
But it won't happen by hoping it will

20:38:40 From Aaron Boley to Everyone:
@Moriba. Why might not even need a strict definition to start, but a recognition that full environmental assessments are needed

20:39:07 From Moriba Jah to Everyone:
yup...it's meant to be dynamic and evolving. Perfect is the enemy of good enough

20:39:14 From Aaron Boley to Everyone:
^

20:39:37 From Timiebi Aganaba to Everyone:
Domain is military language, but is agreed! Global commons is not

20:40:21 From ASE Will Joy to Everyone:
Marne Street: By allowing universal access to the internet aren't these new broadband constellations of this common space to enable the world to have opportunities for all previously who have been 'disconnected'

20:40:23 From Jonathan McDowell to Everyone:
Domain is also mathematician's language!

20:41:16 From Samantha Lawler (she/her) to Everyone:
always good to keep in mind that these companies are not charities! Access to global internet cost lots of money - more than many in remote communities can afford

20:41:29 From Pippa Goldschmidt to Everyone:
We need that feeling of connectivity with the universe for fundamental science and an understanding of our own planet - Newton made the connection between the motions of the planets and the fall of apples because those planets could be seen. what is 'out there' in connected both psychologically and physically with what is on our planet, and a cage of satellites threatens that.

20:42:23 From Brian Weeden to Everyone:
domain is also widely used in the sciences and software world :)

20:42:54 From Timiebi Aganaba to Everyone:
SO many people have defined domains, but even us lawyers don't know how to properly define the commons

20:43:54 From Brian Weeden to Everyone:

a big part of the challenge is that "commons" have different meanings/implications in economic, legal, and political contexts

20:44:00 From Brian Weeden to Everyone:

*has

20:44:05 From Moriba Jah to Everyone:

See <http://eyesonthesky.org> for mixed reality storytelling and science communication on this topic

20:44:14 From Timiebi Aganaba to Everyone:

Yes Brian thats it.

20:44:30 From ASE Will Joy to Everyone:

Caroline Mendes Question to the panel...at what point do they predict "Peak satellite" ...when demand peaks and supply dies off...similar to Peak Oil..surely there will be a case for this?

20:47:41 From Jarita Holbrook to Everyone:

Questions about space junk?

20:49:55 From Stuart Eves to Everyone:

ESA estimates 900,000 objects larger than 1cm in Earth orbit. NASA's estimate of the same number is 500,000. How do we resolve the uncertainty?

20:50:13 From Katherine Courtney to Everyone:

OECD, WEF, UN - all emphasise the digital divide as the biggest issue the world needs to tackle to tackle other global problems like instability, poverty, inequality. Satellites have a role to play in connecting the 3.7bn people h

20:50:22 From Katherine Courtney to Everyone:

Who today have not access to the internet.

20:50:30 From Amy Mehlman to Everyone:

We also just had a debris strike of the ISS. Considered a "lucky strike."

20:51:09 From Catherine Heymans to Everyone:

Q&A: Does the space junk create the cage Brian talked about - will it trap us on Earth?

20:52:16 From Moriba Jah to Everyone:

We also don't seem to consider the predation of untrackable objects on the trackable set. This also matters and we have continual evidence of this on-orbit predation.

20:52:25 From Katherine Courtney to Everyone:

Please visit www.gnosisnetwork.org - We're keen to receive proposals for collaborative projects between researchers and businesses to try to tackle the space sustainability challenge.

20:54:32 From ASE Will Joy to Everyone:

Josef Sebera: Apart from legal definition(s) of space junk, the junk (very soon) will be made by private companies dominantly. Who is expected to pay for the removal? Public? What do the experts expect in this?

20:54:50 From Andy Lawrence to Everyone:

I like that latest public question!

20:55:14 From Jarita Holbrook to Everyone:

I will use it.

20:56:29 From ASE Will Joy to Everyone:

Jonathan Code: I would like Alan to speak to emissions, launch effects on an already unstable atmosphere and why we are talking about lowering impact from international airplane travel while we launch these rockets

20:56:44 From Don Pollacco to Everyone:

there are >500000 bits of debris - mostly not satellites but each capable of killing satellites. Space is huge but we need to know accurately where all this stuff is

20:57:27 From Andy Lawrence to Everyone:

Some fantastic stuff in the chat and we can't ask all of it ... but it will be saved and made available

20:58:19 From Jarita Holbrook to Everyone:

Are we out of time?

20:59:28 From ASE Will Joy to Everyone:
Debra: What about the constant de-orbiting of the sats over time. How will that affect the Earth's atmosphere, ozone?

21:00:10 From Aaron Boley to Everyone:
We just need to be careful about Flags of Convenience, free-riding, etc. So there does need to be an international approach, too

21:00:13 From Katherine Courtney to Everyone:
Excellent point by Don Pollacco. We need an accurate verifiable digital twin of the night sky. Higher quality data, transparently shared and with better analytics and modelling. This is a cross-disciplinary problem - not just one for astronomers or satellite engineers!

21:00:55 From ASE Will Joy to Everyone:
and de-orbiting

21:01:28 From Aaron Boley to Everyone:
But carbon is not the main metric

21:01:56 From Aaron Boley to Everyone:
We need to worry about mesospheric cloud formation, ozone depletion, and alumina deposition.

21:02:18 From stefano gallozzi to Everyone:
with 100thousands satellites the deorbiting rate could be from 5000 to 10000 each year so from 10 to 20 events each day

21:02:28 From Aaron Boley to Everyone:
Soots are problematic, of course.

21:02:36 From Brian Weeden to Everyone:
Aerospace Corporation has done some good research on atmospheric pollution from space launches (primarily soots from solid rockets)

21:03:53 From Dinz Dinsley - NORSS to Everyone:
Where does the military fit into this discussion. An earlier panellist made a great point on the growth of the sustainability debate to replace the focus on the security debate however the majority of space tracking sensors are military property. We need a civil focused space tracking infrastructure to support the sustainability needs of the environment.

21:04:10 From ASE Will Joy to Everyone:
Bryce Malton: How broad is the LEO altitude band - what is the vertical spacing that has to be maintained

21:04:21 From Timiebi Aganaba to Everyone:
Hi Dinz, of course you. Know about Northstars constellation

21:05:23 From Katherine Courtney to Everyone:
The stock of scientists is pretty high at the moment - I'd encourage researchers to make their voices heard to policy makers!

21:06:13 From Moriba Jah to Everyone:
How many are getting resourced and funding... lots of doctors and academics and few funded researchers LOL

21:06:47 From Davies, John (STFC,ROE,UKATC) to Everyone:
How realistic are these space debris missions. It seems like a lot of trouble to capture one dead satellite. is this a realsit

21:07:01 From Dinz Dinsley - NORSS to Everyone:
Hi Timiebi, I do and welcome it joining the sensor "toolbox" in the future but currently governments are focusing on funding SST through the defence departments...I also welcome the dept of commerce developing their capability more.

21:07:29 From Dinz Dinsley - NORSS to Everyone:
But developments are slow

21:07:30 From Davies, John (STFC,ROE,UKATC) to Everyone:
realistic way forward or just a stunt?

21:07:32 From Jonathan McDowell to Everyone:

I still worry most about pollution in the upper stratosphere and mesosphere... the total mass of the mesosphere is so much smaller than the lower atmosphere that it must be easier to perturb its chemistry and I'm not sure how well understood that is

21:07:42 From Meredith Rawls to Everyone:

who is monitoring the youtube chat? we have a spammer that needs kicking out

21:08:07 From Timiebi Aganaba to Everyone:

Pls join us on Friday where I am moderating a discussion with Northstar and the Dept of Commerce <https://www.eventbrite.com/e/our-future-in-space-tickets-158641810927>

21:08:20 From ASE Will Joy to Everyone:

Kate Arkless Gray: Question for @andy lawrence - could he collect any interesting papers/writings that the guests could share and share them on Twitter please? Thanks!

21:10:57 From ASE Will Joy to Everyone:

P FITZ: most of the light pollution is caused by the solar panels, perhaps they could be designed to track the sun and any reflected light to be directed away from the Earth

21:14:04 From ASE Will Joy to Everyone:

Michael Peel: If countries are liable if their satellites impact other countries ... does that mean astronomers in other countries can sue for damages?

21:14:25 From Andy Lawrence to Everyone:

I like that Michael Peel Q...

21:14:34 From Hugh Lewis to Everyone:

"Off the shelf" science/law is, perhaps, another symptom of short-termism. When we're dealing with satellites (and other objects) that will take 1000s years to re-enter, we need to have a different perspective don't we? One involving deeper time. I think Aparna mentioned that space is an ancestral commons. Taking this perspective, maybe we should consider ourselves the ancestors for all future generations. Doesn't framing the problem in this way change how we approach the problem?

21:14:50 From Timiebi Aganaba to Everyone:

Can astronomers show "physical" damage?

21:15:15 From Amy Mehlman to Everyone:

It goes beyond liability as others are impacted regardless of whether there is a collision or debris strike. There are other issues like what was mentioned earlier such as monopolization of orbits and spectrum interference concerns.

21:16:20 From Aaron Boley to Everyone:

@Timi: If a radio receiver is blown, that would be physical damage to property.

21:16:28 From Mark McCaughrean to Everyone:

@Hugh Lewis – Fully agreed. If there had been time, I would have asked Brian how he sees this in the context of his Long Now foundation, i.e. taking a long-term perspective on the world we are leaving behind. To state the obvious, our modern society is extremely bad at doing that.

21:16:32 From Aaron Boley to Everyone:

Star streaks would be harder to argue

21:16:35 From Davies, John (STFC,ROE,UKATC) to Everyone:

There is a cost to even those mitigations which are possible. Extra frames, repeat observations, software being written and updated all cost something.

21:16:42 From ASE Will Joy to Everyone:

Martin Dominik: Liability is a good question. Can somebody from the panel comment on that?

21:16:48 From ian smith to Everyone:

But how to we suspend Starlink launches whilst treaty negotiating proceeds.

21:17:10 From Aaron Boley to Everyone:

satellite streaks

21:17:31 From Tim Maclay to Everyone:

@John - missions to remove debris are real, but as with any new industry where new capabilities need to be developed, initial demonstrations are very expensive. Typically

governments seed industry by funding technology development and demonstrations, and these capabilities are then commercialized over time. Costs will come down and new applications will emerge, but government budgets are often required to get it all started.

21:17:57 From Timiebi Aganaba to Everyone:

Ian it took 10 years to negotiate non binding rules..so if you want space x to wait till there's a treaty you are effectively killing them

21:18:16 From Samantha Lawler (she/her) to Everyone:

if an asteroid hits Earth that was missed because of extra noise caused by satellites, that would certainly be physical damage! But hard to prove legally, I'd imagine

21:18:23 From Samantha Lawler (she/her) to Everyone:

(also we'll have bigger problems at that point)

21:18:43 From Brian Weeden to Everyone:

@Ian and it's just not practical - SpaceX already has initial approval from the FCC to launch

21:19:43 From Mark McCaughrean to Everyone:

@Timiebi - I'd suggest that Space X & others are well aware that there's a massive asymmetry between the speed at which we can fill the skies & that at which we can develop & agree on binding legislation. They're making this a fait accompli.

21:20:10 From Davies, John (STFC,ROE,UKATC) to Everyone:

yes roger that. I understand that you have to start with proof of concept missions. I can see that special cases may be cost effective but as a general rule, is this going to be cost effective for routine operations?

21:21:18 From Timiebi Aganaba to Everyone:

Well Viasats motion is asking the court to say that they should not launch any more satellites till we have looked into the risks more. Its a tough thing to put to a court who have no clue about these issues and the implications of the decision

21:22:03 From ASE Will Joy to Everyone:

Martin Dominik: The Artemis Accords undermine the Outer Space Treaty by claiming that those carrying out space activities can regulate these themselves without the need for an agreement under international law

21:22:51 From Hugh Lewis to Everyone:

@Mark: agree that companies are making this a fait accompli. IADC, UN, ISO, etc. cannot work at the same pace. Question, then, is how to show/persuade/appeal to companies to demonstrate caution, care, stewardship? What levers are left to pull?

21:23:11 From Brian Weeden to Everyone:

@Timiebi Agreed. And even if that lawsuit is successful, these constellations are also being licensed by the UK, Canada, China, France, Papua New Guinea, and others.

21:23:12 From Andy Lawrence to Everyone:

Time for Qs in this section?

21:23:23 From Brian Eno to Everyone:

It needs for people to act: law won't be fast enough, and anyway the targets of the laws can slip off to other jurisdictions (cf billionaires and taxes). We need a change in social attitude towards the whole subject - as we are seeing a change in social attitudes to rainforests and food production. Call Extinction Rebellion and get them to set up a Space Department!

21:23:31 From Dinz Dinsley - NORSS to Everyone:

All things point to the conundrum faced by governments trying to support 'economic growth' whilst also supporting sustainability. The governments regulate and therefore have the power to say no...or do they? After all they also receive income from issuing licenses. And currently how often are the operators held to count if they break the rules? The information available is not necessarily available to prove bad actions have occurred.

21:24:10 From Andy Lawrence to Everyone:

Q for Chris: I have heard you talk about "Greenpeace for Space" - is that a serious idea?

21:24:44 From Timiebi Aganaba to Everyone:

@Hugh Some projects like the space sustainability rating are trying to motivate people to act responsibly

21:25:39 From ASE Will Joy to Everyone:

Chris Lee: The case should be simple. No megaconstellation gets full approval until it demonstrates no environmental impact. It may need to trial with a few sats to pass the gates for next stage.

21:25:40 From Hugh Lewis to Everyone:

@Brian Eno: agreed! The challenge is that space is 'out of sight, out of mind' and most people probably don't have same sense of caring for space as they do for space environment. This is where I believe the issues facing the night sky can play a huge role. Everyone should have access to a pristine sky. That's something people can more easily get behind, I think.

21:26:21 From Don Pollacco to Everyone:

who will push the Borneo regulators????

21:26:22 From Mark McCaughrean to Everyone:

@Hugh I wish I knew, but I agree with Brian – this needs to be made visible & relevant to a far wider public than space industry insiders like astronomers. Governments react to lobbyists on one hand, but the general public *can* have greater power on the other *if* they're mobilised. I guess the problem is that many in the public are already saturated with enormous challenges such as climate change & only have limited capacity to take on another existential threat.

21:27:00 From Amy Mehlman to Everyone:

Yes! Market access applications are key. This is where the rubber hits the road.

21:27:10 From Dinz Dinsley - NORSS to Everyone:

Democratisation of the data of space...remove it from behind the military firewall!

21:27:10 From Andy Lawrence to Everyone:

Q: how do we stop flags of convenience?

21:27:24 From stefano gallozzi to Everyone:

<https://astronomersappeal.wordpress.com/>

21:27:30 From ASE Will Joy to Everyone:

Martin Dominik: What is the stance of countries that don't have ambitions for megaconstellation projects?

21:27:45 From Hugh Lewis to Everyone:

@Timiebi: thanks - Space Sustainability Rating is too opaque & too complex (yet, also not comprehensive enough) in my humble opinion.

21:27:59 From Stuart Eves to Everyone:

UN space licensing?

21:28:09 From stefano gallozzi to Everyone:

<https://astronomersappeal.wordpress.com/safeguarding-the-astronomical-sky-foundation-sas-foundation/>

21:28:11 From Timiebi Aganaba to Everyone:

Good to know @Hugh

21:29:12 From Brian Weeden to Everyone:

@Hugh OST gives oversight/licensing power to States, not the UN. so a UN licensing system would require a fundamental rework of international space law, which States would need to agree to

21:29:13 From Andrew Williams (ESO) to Everyone:

Can someone comment on the recent G7 statement about sustainability of space?

21:30:00 From Tim Maclay to Everyone:

@John - Great question. The viability of commercial debris removal services remains to be demonstrated. It will depend on the value proposition, which is a function of both cost, and the benefit perceived by the customer. Governments that are concerned about liability may be willing to pay what it costs to remove large objects. Cubesat operators ... pretty unlikely.

21:30:07 From Dinz Dinsley - NORSS to Everyone:

@Brian and will take forever to create

21:30:09 From Andy Lawrence to Everyone:

@Andrew Williams I certainly will if others don't!

21:30:37 From Hugh Lewis to Everyone:

@Brian Weeden: states look to UN for consensus on behaviour, don't they? If UN works slowly, then how should states address the faster pace of companies?

21:30:54 From Alan Thompson to Everyone:

@Chris but the problem of the invested effort to get this up the politicians list inevitably will result in a "sensationalist" or almost hysterical level of intensity in order to deliver the message.

21:31:33 From Timiebi Aganaba to Everyone:

Here is the article Catherine just mentioned - looks like a good read <https://www.scientificamerican.com/article/spacex-starlink-mega-constellation-faces-fresh-legal-challenge/?amp=true>

21:31:43 From Mark McCaughrean to Everyone:

It's also important to find a way of making this local & actionable, so that people understand the impact that this will have on *them*, & what is is they can do in response, beyond waking up at 4am with this as another existential worry. All the while, realising that the operators are very experienced at selling products that will "improve your life" in a positive manner.

21:32:06 From ASE Will Joy to Everyone:

Ben Levi: Space Peace is essential! Otherwise we're already weaponizing space... the next military arena.

21:32:35 From Samantha Lawler (she/her) to Everyone:

This is a document Aaron Boley and I + other Canadian astronomers wrote on recommendations for the Canadian government: <https://arxiv.org/pdf/2104.05733.pdf>

21:32:51 From Samantha Lawler (she/her) to Everyone:

could possibly be helpful for other governments? (especially non-launching governments like Canada)

21:34:48 From Hugh Lewis to Everyone:

@Mark: I am trying to work on a longer, personal piece addressing the issue of why we should care. One idea I am looking at is 'nostalgia for the future' which I think is at the heart of solutions to many of our environmental problems. The question is, then, how do we instil a sense of nostalgia for the future of space? Of the night sky?

21:35:10 From Katherine Courtney to Everyone:

Also - every letter to a Minister has to be answered - by a policy official! Get those emails going!

21:35:44 From Don Pollacco to Everyone:

the G7 didnt have to make any statement - so the fact they did is something

21:36:11 From Timiebi Aganaba to Everyone:

@hugh you may enjoy this re your discussions around nostalgia <https://cpb-us-e1.wpmucdn.com/blogs.gwu.edu/dist/7/314/files/2018/10/Delgado-Lopez-When-Inspiration-Fails-to-Inspire-A-change-of-strategy-for-the-US-space-program-1e073e9.pdf>

21:36:12 From Katherine Courtney to Everyone:

I agree Don. Small steps in the right direction!

21:36:45 From Don Pollacco to Everyone:

good session KC

21:36:46 From ASE Will Joy to Everyone:

Martin Dominik:A global set of laws can only derive from the initiative of national states

21:36:49 From Hugh Lewis to Everyone:

Thanks @Timiebi!

21:36:53 From Amy Mehlman to Everyone:

Thanks to you, Andy, and to everyone for your interest and leadership on these issues.

21:37:07 From Pippa Goldschmidt to Everyone:

Science fiction is a powerful way of engaging the public - 'Gravity' probably has done more for the cause of dealing with space junk than any Govt policy paper.

21:37:25 From Brian Eno to Everyone:

All environmental campaigns start with a surge of empathy - for the planet. We need to make people fall in love (again) with space and the Universe. It sounds romantic but - hey! - David Attenborough did it for Earth.

21:38:04 From Hugh Lewis to Everyone:

@Brian Eno: completely agree!

21:38:17 From Katherine Courtney to Everyone:

Thanks for a stimulating discussion Andy!

21:38:55 From Hugh Lewis to Everyone:

ANDY - also mention Secure World Foundation Space Sustainability Summit next week?

21:38:57 From stefano gallozzi to Everyone:

I agree with Andy that law strategy will not fix definitely any issue but can pronounce to force governments in agree on international ruling and put on hang satellites launches in order to take times for that.

21:39:07 From Aparna Venkatesan to Everyone:

SATCON2 announcement - registration and site will be open soon - July 12-16, 2021: <https://noirlab.edu/public/announcements/ann21021/>

21:39:08 From Nicholas Ross to Everyone:

Huge, huge thanks to Andy and everyone who spoke. Great discussions. Reminds me of Margaret Mead's famous quote!

21:39:29 From Mark McCaughrean to Everyone:

@Hugh The cynic in me wonders whether this issue can be solved in isolation, or whether it will be solved as part of a much more wide-ranging reappraisal of the way our world & society work. Climate change pretty much guarantees that that's going to happen - the real question is how proactive we're willing to be as a society to make that happen in a way that's less catastrophic than the alternative we appear to be headed towards.

21:39:38 From Hugh Lewis to Everyone:

Sorry Andy - should have guessed that you would have already thought to go to Brian!

21:39:59 From Brian Weeden to Everyone:

got my video turned back on just in time!

21:40:29 From Katherine Courtney to Everyone:

@Brian Eno - Maybe Sir David would take an interest? And Brian Cox and Maggie Aderin-Pocock etc...

21:40:45 From Hugh Lewis to Everyone:

@Mark: yes, you're right. We humans seem to want to wait for catastrophe before acting. Not a good long-term strategy!

21:40:49 From Brian Weeden to Everyone:

and Andy, thanks for the opportunity for a shout-out

21:40:58 From Aaron Boley to Everyone:

Thank you!

21:41:02 From Dinz Dinsley - NORSS to Everyone:

Fantastic event...thank you Andy and thank you to all the participants and the great comments and questions

21:41:08 From Timiebi Aganaba to Everyone:

Thanks

21:41:11 From Don Pollacco to Everyone:

thanks everyone

21:41:12 From Rob Beswick to Everyone:

Thanks

21:41:12 From Andrew Williams (ESO) to Everyone:

thanks!

21:41:14 From Christopher Newman to Everyone:
Wonderful discussions - many thanks

21:41:23 From Aparna Venkatesan to Everyone:
Gratitude for this chance to partner and share

21:41:25 From stefano gallozzi to Everyone:
goodby thank you Andy

21:41:27 From Andy Lawrence to Everyone:
so are we off stream now?

21:41:27 From ASE Will Joy to Everyone:
great thanks from all of YouTube!

21:41:40 From Pippa Goldschmidt to Everyone:
thanks everyone, fascinating talks

21:42:08 From Mark McCaughrean to Everyone:
Thanks, Andy, & everyone else. There was a lot of great stuff there & it would indeed be great if the comments here can be archived & made available to the participants.

21:43:38 From Alan Thompson to Everyone:
thank you very much Andy for the invitation!