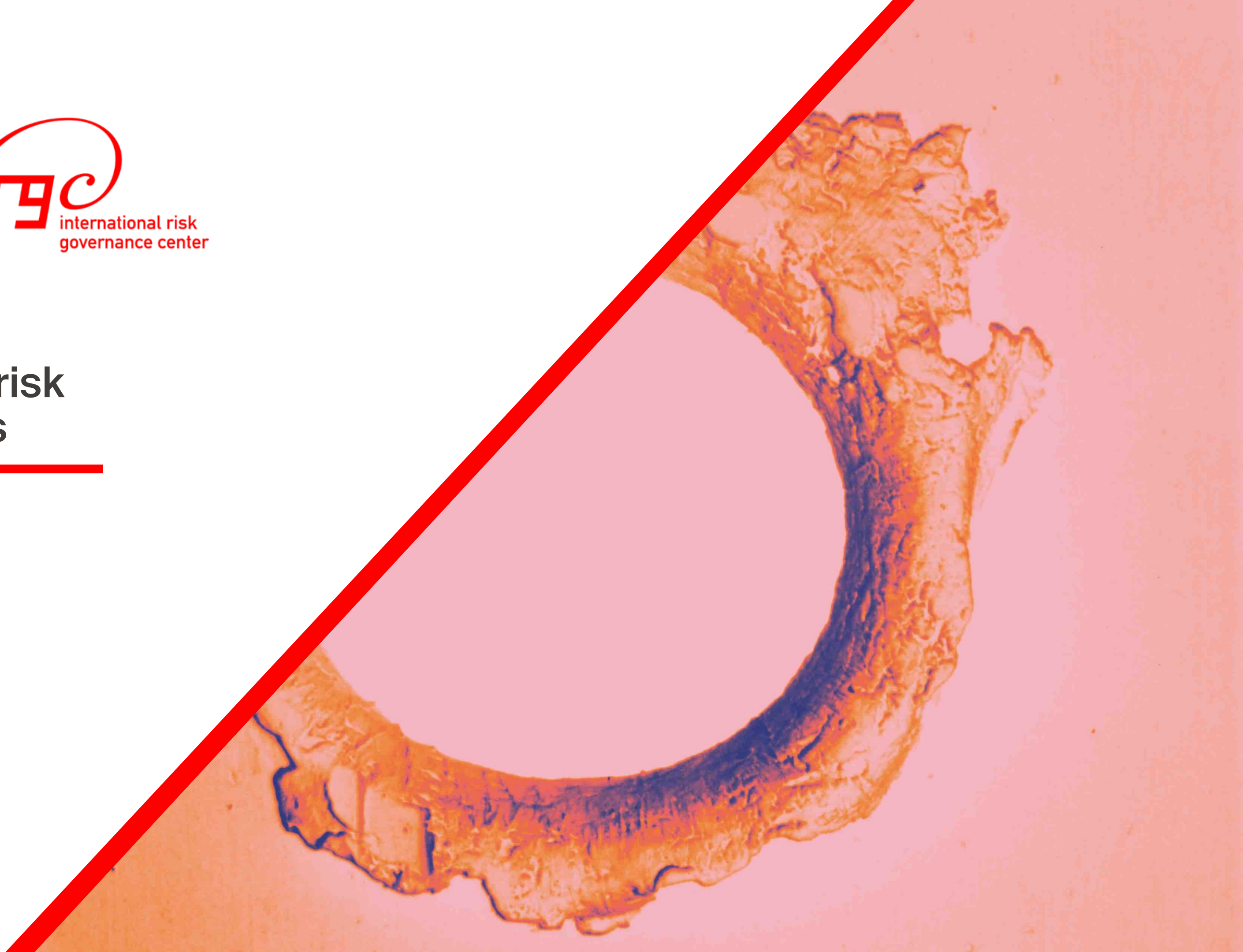
Policy options to address collision risk from space debris



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December 2021

Presentation outline

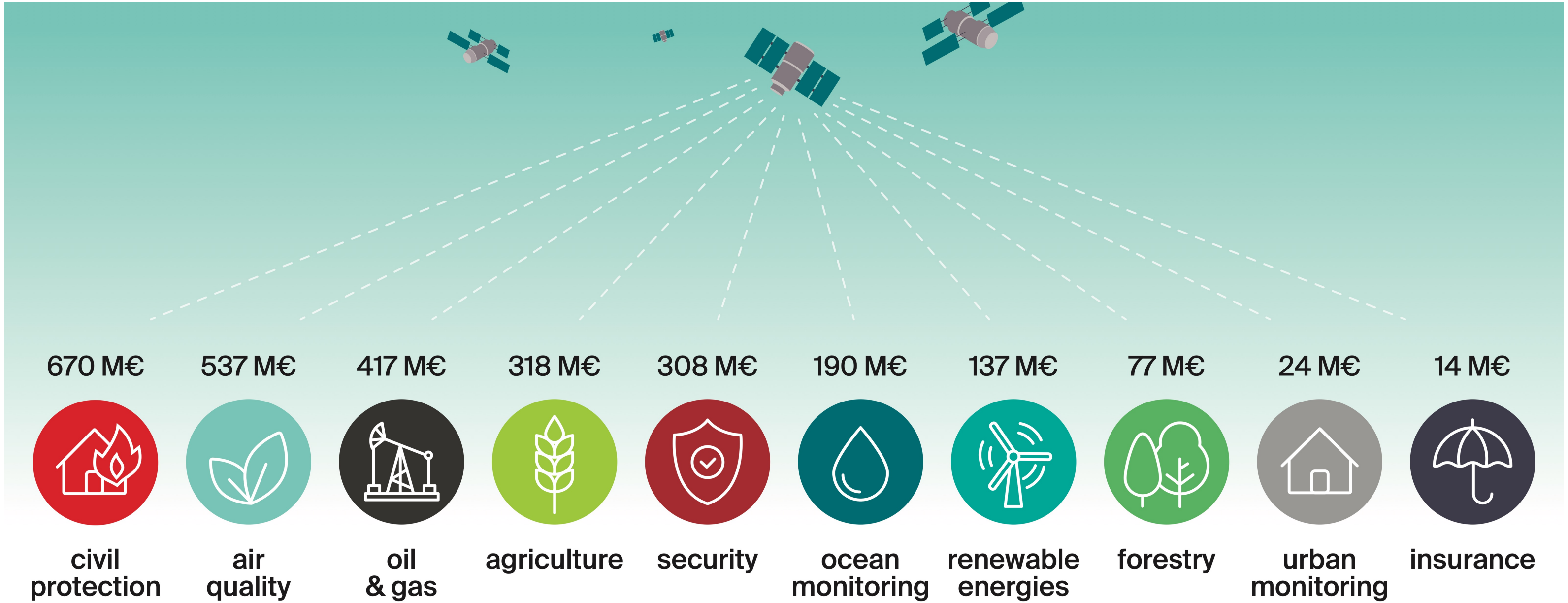
Introduction

1. Risk assessment and evaluation
2. Technology development and implementation
3. Regulatory requirements and compliance
4. Multilevel governance of collision risk

Conclusion

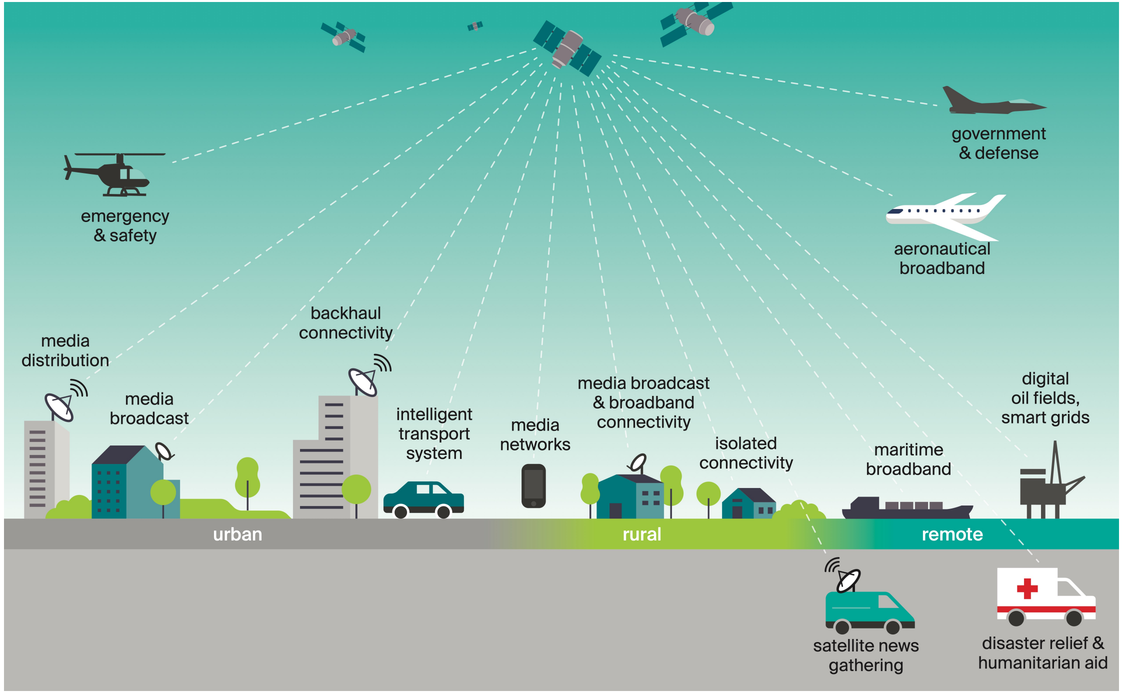
Introduction

A growing reliance on space-based infrastructure: Earth observation



End-users revenues enabled by the European Earth observation program Copernicus in 2018 in EUR million (data from European Commission, 2019)

A growing reliance on space-based infrastructure: Communications



Interconnected satellite 5G network (adapted from Giambene et al., 2018)

Incomplete assessment should not delay action

- IRGC's policy brief Policy options to address collision risk from space debris offers a range of policy options and generic recommendations to improve the assessment, evaluation and management of collision risk.
- IRGC's opinion is that **a complete evidence-based evaluation of the risk, response options and associated cost is still missing.**
  - Reasons for this include uncertainties about the future behaviour of space actors, the implementation of non-binding guidelines and the costs/benefits of mitigation and remediation approaches.
- However, IRGC's opinion is that **incomplete assessment should not delay action.**
  - The development and deployment of technology to manage the risk and the implementation of best practices should be encouraged and rewarded, including through economic incentives.

A menu of policy options

The policy brief offers a menu of policy options to

- support or mandate a more comprehensive evaluation of the risk,
- foster the development and deployment of technology for mitigation and remediation, and the implementation of best practices,
- enhance national regulations and the supervision of space activities, and
- engage in international collaboration and build capacity across different governance levels.

1

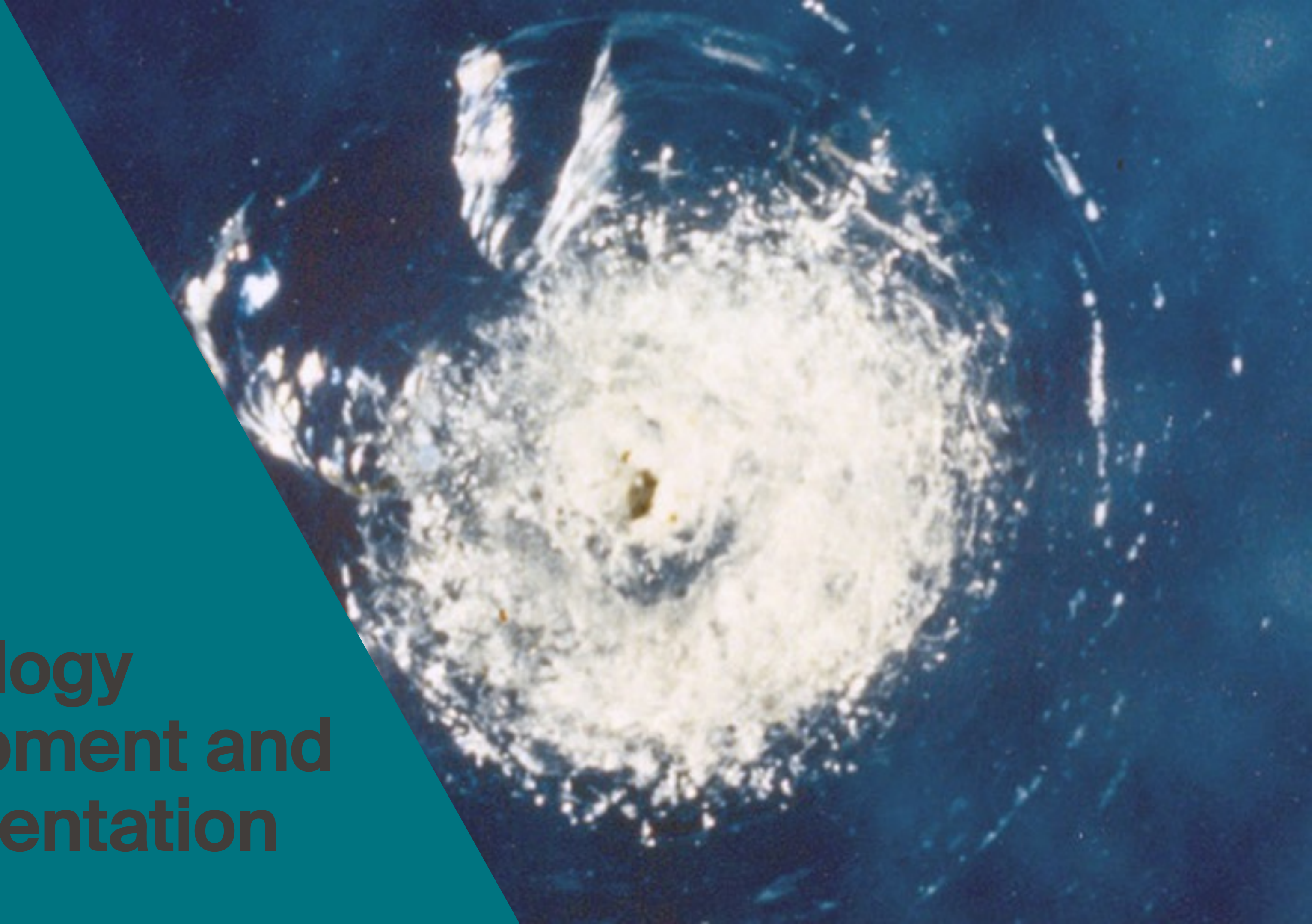
Risk assessment and evaluation

Risk assessment and evaluation

- Broaden the framing of the risk
  - A broader perspective on the context and system in which the risk develops will give a better understanding of the wider impacts on Earth and help broaden the management strategies by addressing collision risk in the wider absorbing systems.
- Develop and use common metrics to measure the risk
  - The assessment of the risk level and its potential evolution in the future would benefit from the development of commonly agreed-upon evidence-based metrics.
- Analyse stakeholders’ concerns and behaviour
  - Increasing the understanding of space actors’ behaviour and their drivers is instrumental in improving risk evaluation and selecting acceptable response strategies.

2

Technology development and implementation



Technology development and implementation

- Availability of mature cost-effective technologies can help raise the standard of care and help avoid implementing more radical solutions.
- Reducing collision risk can be achieved by:
  - improving the tracking and cataloguing of objects to enhance the effectiveness of collision avoidance strategies,
  - reducing the likelihood of explosion,
  - making sure spacecraft are de-orbited at end-of-life, and
  - remediation activities.
- These four streams of activities rely on the implementation of **best practices** and appropriate **technology**. Risk reduction potential, costs and feasibility of these different activities should be compared while keeping in mind that they might be complementary and help reduce different aspects of the risk.

3

Regulatory requirements and compliance

Regulatory requirements and compliance

- National regulatory authorities can mandate or incentivise the adoption of best-available cost-effective technologies for space debris mitigation and remediation.
- Promising options to reduce collision risk from space debris include organising the collection and sharing of data on space debris impacts and **requirements** on
  - manoeuvrability capabilities,
  - trajectory information sharing and independent tracking, and
  - reduced post-mission orbital lifetime.
- Regulatory authorities must not only enact requirements, but they must also ensure that operators respect the commitments made to obtain a license.
  - Continuous **supervision** and **ex-post monitoring** of commercial and governmental activities is needed.

4

Multilevel governance of collision risk

Multilevel governance of collision risk

- In the long-term, effective global governance of risks related to space debris likely requires agreement among space actors on a management strategy, including sharing costs and benefits from space utilisation.
- In the short-term, unilateral but coordinated action can be effective.
  - Some plurilateral actions by several like-minded states should also be encouraged.
  - The risk of forum shopping can be to some extent addressed by market entry requirements and reputational aspects.
  - It needs to be accompanied by transparent discussions at the international level.
- Raising awareness around the issue and bridging knowledge gaps between stakeholders are stepping stones to building consensus around an international management strategy.
- To reach a shared vision, it would also be useful to elaborate scenarios of possible mid- to long-term futures concerning the civilian use of space.

Conclusion

Process recommendations towards safe and sustainable space activities

Three overarching process recommendations to pave the way towards ensuring safe and sustainable space activities in the long term:

1. More collaborative work is needed to improve the framing and evaluation of the risk.
2. A larger and more committed political involvement at the national and international level will be instrumental to any progress.
3. In addition to space actors, other stakeholders that use or benefit from space-related activities should be involved in the discussion.

A

Appendix

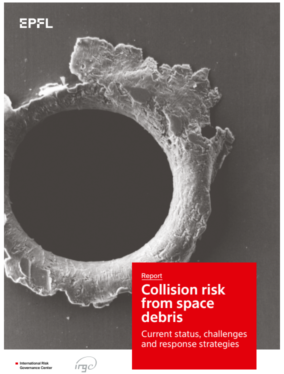
EPFL

The International Risk Governance Center (IRGC)

- IRGC is an interdisciplinary unit dedicated to extending knowledge about the increasingly complex, uncertain and ambiguous risks that affect society.
- We develop risk governance strategies that involve all key stakeholder groups, including citizens, governments, businesses and academia.
- Our work is rooted in the IRGC Risk Governance Framework, as well as subsequent guidelines that were developed to more specifically address the challenges posed by governance of emerging and systemic risks.
- We apply these guidelines to a wide range of specific risk domains, and in recent years we have focused increasingly on risks associated with emerging technologies.

IRGC's work on space

Buchs, R. (2021). *Intensifying space activity calls for increased scrutiny of risks*. Lausanne: EPFL International Risk Governance Center.
DOI: [10.5075/epfl-irgc-284971](https://doi.org/10.5075/epfl-irgc-284971)



Buchs, R. (2021). *Collision risk from space debris: Current status, challenges and response strategies*. Lausanne: EPFL International Risk Governance Center.
DOI: [10.5075/epfl-irgc-285976](https://doi.org/10.5075/epfl-irgc-285976)

Buchs, R. (2021). *Policy options to address collision risk from space debris*. Lausanne: EPFL International Risk Governance Center.
DOI: [10.5075/epfl-irgc-290017](https://doi.org/10.5075/epfl-irgc-290017)

References

- See references and figures credit in *Policy options to address collision risk from space debris*.
- Selected references:

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- Slide 12: Feuge-Miller et al. (2021), DOI: 10.18738/T8/PYWBDN
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