

## CURRICULUM VITAE (16th July 2024)



### Personal data:

Name: Marko Tapio Höyhtyä  
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 Country of citizenship: Finland  
 Website: <https://scholar.google.com/citations?user=QVkf0MAAAAJ&hl=fi&oi=ao>

### • Education and degrees awarded

- Adjunct Professor (Docent), National Defence University of Finland since June 2021. Topic: “Integrated satellite-terrestrial communications systems”
- Adjunct Professor (Docent), University of Oulu, Finland since November 2018. Topic: “Communications solutions for remote controlled and autonomous systems.”
- Doctor of Science in Telecommunications Engineering, University of Oulu, Finland. Date of graduation: 23 September 2014. Thesis title: “Adaptive power and frequency allocation strategies in cognitive radio systems”.
- Master of Science in Information Technology Engineering, University of Oulu, Finland. Date of graduation: 19 September 2005. Thesis title: “Adaptive power control as inverse control in multipath fading channel”.

### • Other education and training, qualifications and skills

- Project manager in both national and international research projects
- Satnex Satellite Communications Summer school, Malta 2017
- Multiple courses on project funding and management, leadership of people at VTT (2009-2020)
- DARE thought leadership course 2020
- IPMA Level C Project management certificate 2021, professional project manager
- Coursera certificates on courses *Machine Learning* and *Astronomy: Exploring Time and Space*, 2022

### • Current position

- **Associate professor on technology adaptation and forecasting at the Finnish National Defence University**
- Leading research on emerging disruptive technologies such as satellites, quantum, drones and 6G and their adaptation to military needs. Supervision of researchers and students.

### • Previous work experience

- Research professor on satellite communications and situational awareness at VTT.
- Leading space technology research including communications and remote sensing. Strategic planning, project preparations and management, supervision of researchers
- Situational Awareness theme lead covering planning of VTT’s roadmap and coordinating research topics covering data acquisition, data analytics, data presentation and decision making since 1/2022
- Responsible for strategic collaboration between ESA and VTT (5G and beyond satellite-terrestrial connectivity) since 1/2019
- Visiting research fellow at the European Space Agency: Integrated 5G and beyond satellite-terrestrial systems. 4/2019-6/2019.
- New Space Co-Creation Manager and principal scientist at VTT Technical Research Centre of Finland. 3/2019–8/2022.
- HX research ecosystem lead 7/2020-4/2022. Leading research consortium/ecosystem consisting of VTT and main Finnish universities + tens of companies. The preparations of more than 70 project proposals are part of indirect industrial participation related to next generation fighters for the Finnish Air Force
- Research Team leader of “Autonomous Systems Connectivity,” VTT. 1/2018-4/2019.
- Senior research scientist, research scientist: Satellite communications, spectrum sharing and measurements, autonomous ships, 5G, VTT Technical Research Centre of Finland, Oulu. 10/2005 - 12/2017.
- Visiting research scientist at the Berkeley Wireless Research Center (BWRC), University of Berkeley, CA. Research on adaptive transmission techniques for cognitive radio. 2/2007 - 2/2008.

- **Research funding, leadership and supervision**

- Dr. Höyhtyä has led following projects and was mainly responsible in preparation of funding applications:
  - 1) RATIONALE project (May 2009 - February 2012), funded mainly by Scientific Advisory Board of the Finnish Defense Forces (MATINE). Topic: Application of the Theory of Rational Decision-making to Adaptive Transmission. Amount of funding: 160 000 €.
  - 2) SANTA CLOUDS project (June 2011 - September 2013) focused on development of useful techniques and applications exploiting cooperative and cognitive communication principles in a wireless communication system. The project mainly funded by Tekes - the Finnish Funding Agency for Innovation. Amount of funding: 998 999 €.
  - 3) ESA ACROSS (September 2011 - May 2012), funded by European Space agency. The project was the first ESA funded activity on application of cognitive radio techniques to satellite systems. Amount of funding: 100 000 €.
  - 4) ESA FREESTONE (July 2013 - September 2015) ESA funded activity on frequency sharing in satellite communications. Amount of funding: 500 000 €.
  - 5) ViRePAS project (January 2017 - December 2017) focusing on development of virtual research platform for autonomous ships and relevant technologies. Amount of funding: 200 000 €.
  - 6) ESA ASCENT project (April 2018 - October 2020) focusing on development of licensed shared access testbed for integrated 5G satellite-terrestrial systems. Amount of funding: 660 000 €
  - 7) Space Technology Development project at VTT (January 2019 - December 2019) covering many topics such as constellation design, additive manufacturing, hyperspectral imaging and integrated networking. Amount of funding 750 000 €
  - 8) 6G\_Sat project (May 2021-October 2021) developing roadmap and solutions towards 6G satellite communications networks. Project funded partly by Business Finland. Amount of funding 100 000 €
  - 9) Challenge Focus Space project (1/2022-12/2022) developing state-of-the art observation and connectivity technologies for space and roadmap work for the future. Amount of funding 800 000 €
  - 10) Challenge Focus Situational Awareness project (1/2023-12/2023) developing sensor technologies, data analytics, connectivity and cybersecurity for critical situational awareness such as border guard. Amount of funding 800 000 €.
  - 11) 6G-SatMTC project (April 2023-October 2025), developing machine-type connectivity and direct-to-satellite connections to public safety, autonomous maritime systems, and remote mines. Business Finland funding the project, VTT budget 481 000 €.
  - 12) EDF SPIDER project (1/2024 – 12/2025), space-based intelligence, surveillance, and reconnaissance (ISR) development for European needs, VTT budget 2 M€.
- In addition, several other projects in different forums. Some latest examples include Business Finland/Tekes projects SEAMUS (2019), NESTOR (2020), CORNET (2017-2019), EU funded project EuWireless (2018-2020), multiple ESA projects, and *several millions of confidential customer project funding* (R&D for companies).
- Thesis supervisor for Janne Kusmin's M. Sc thesis in 2012, Anastasia Yastrebova's M. Sc. thesis 2019 and her Ph. D. thesis in 2024. Practically supervisor for the final phases of Juha Kalliovaara's Ph. D. thesis in 2017: "Field measurements in determining the incumbent spectrum utilization and protection criteria in wireless co-existence studies." (see Acknowledgements in the thesis). Currently supervisor of several students at the National Defence University.
- Research of Marko Höyhtyä has received grants from following organizations:
  - Antti and Jenny Wihuri Foundation, Nokia Foundation, Seppo Säynäjäkangas Science Foundation, Finnish Science Foundation for Economics and Technology (KAUTE), Riitta and Jorma J. Takanen Foundation, Oulu University Scholarship Foundation

- **Experience of organising scientific meetings**

- Co-organizer of a CogRAN-SAT workshop in the ICC conference 2015, London (60 participants)
- Organizing 5G track in Finnish satellite workshop, Espoo, January 2019 (300 participants)
- Co-organizing 5G tracks in Finnish satellite workshop, Espoo, January 2020 (500 participants)
- Track chair for "Airborne and Maritime Mobile Systems and Service" in VTC Spring 2021 and VTC Spring 2022
- Organizing committee member of Finnish Satellite Workshop / Winter Satellite workshop since 2021-
- Organizer of the "1st Workshop on integrating MTC and Satellites - Sat-IoT," in *IEEE 9th World Forum on Internet of Things*, October 2023.

- **Patents, inventions, awards and honours**

- More than 10 inventions, patents and patent applications incl. US Patents US9820288, US11129137 B2
- Best paper award from international *CogART 2008 workshop*
- VTT Publication Award for the best scientific publishing activities in 2016.
- Excellent paper award from *ICTC 2017* conference (autonomous ship connectivity)
- Best presentation award from *ICoIAS 2019* conference
- Senior member of IEEE since 2015

- **Other academic merits and selected invited speeches**

- Referee for multiple prestigious journals, including IEEE Journal on Selected Areas in Communications, IEEE Transactions on Cognitive Communications and Networking.
- Keynote speech: “Frequency sharing in satellite communications,” in *IEEE ICC*, London, June 2015.
- Invited speech: “QoS and priority management in 4G and 5G networks,” Master Class in *Critical Communications World*, Hong Kong, May 2017 and several other keynote speeches in the CCW events 2022, 2023, 2024
- Invited speeches in the main event for autonomous ships about connectivity, *Autonomous Ship Technology Symposium* in years 2017, 2018, 2019, Amsterdam
- Invited speeches in Finnish Space Industry Days, 5G-Momentum Webinars, Tieteen Päivät 2023 etc.
- Keynote speech, “Intelligent communication system for smart ships,” *The Smart Ship Exchange*, Athens, October 2019
- Business Finland Webinars to international markets;
  - Situational Awareness: 5G/6G and hyperspectral satellites (Webinar with USA industry, September 2020)
  - Future Visions and Challenges in New Space Economy: 5G and satellite communications (Webcast to Italian industry, January 2021)
  - 5G/6G SatCom development supporting smart and sustainable Europe (Webcast to French industry, November 2021)
- Multiple speeches about 6G and satellite systems in Finnish Satellite Workshop and Winter Satellite Workshop.

- **Scientific and societal impact of research**

- Total number of publications (books, book chapters, journal articles, conference papers) is currently around 100 (h-index 25). See Google Scholar webpage mentioned above
- Contributions in regulatory documents such as ITU-R M.2225, ECC report 232 on satcom
- Several contributions on 3GPP standard on maritime and satellite connectivity (Rel. 16 - Rel. 18)
- A. Hulkkonen, R. Kettunen, J. Ylitalo, and M. Höyhty, “Cognitive tactical communication networks,” *Bittium Defense White Paper*, 18 pp, May 2013. (Important role in writing a white paper for wireless industry)
- Dr. Höyhty has been involved in multiple technology demonstrations where spectrum sharing techniques have been implemented in real networks and devices. His patented spectrum sharing methods have been implemented using SDR platforms. In addition, he has been involved in development of licensed shared access (LSA) and spectrum access system (SAS) demonstrations with companies where the concepts have been implemented in real LTE networks. Dr. Höyhty has presented the concepts e.g., in CROWNCOM and European Wireless conferences.

- **Positions of trust in society and other societal merits**

- Dr. Höyhty was an invited expert in NSF Workshop on Spectrum measurements & Spectrum management (6.4.-7.4.2016 in Chicago). The goal of the workshop was to bring together top tier academic, government and industry researchers to be able to collectively define what are the most important research topics and directions in the area of spectrum measurements in the future. In addition, the workshop supports networking of these professionals. Dr. Höyhty was the only participant from Europe.
- Currently chair of Scientific Advisory Board of Defence (MATINE) “Arctic and Space” theme group.
- Member of NetworldEurope SatCom WG that is e.g., in charge of Strategic Research and Innovation Agenda for EU level research related to non-terrestrial networking technology
- Member of DG DEFIS space expert group on satellite technology, supporting European Commission