
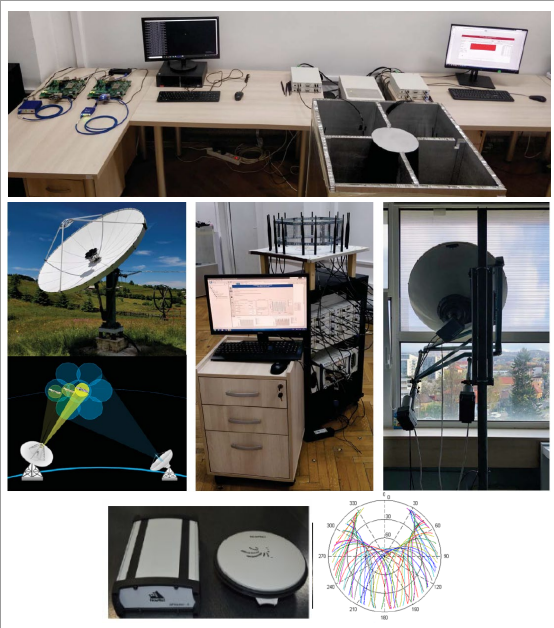


## CENTRE OF COMPETENCE FOR WIRELESS INTRA-SATELLITE TECHNOLOGIES

### Contact details

Name	Centre of competence for wireless Intra-SATellite Technologies
Acronym	IntraSAT-Tech
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### Areas of expertise

**Satellite communications and radio channel characterization:** smart site diversity for high throughput satellite (HTS) systems, advanced atmospheric channel modelling, Q/V band (40-50 GHz) propagation analysis for next generation satellite communication systems and fading mitigation, Global Navigation Satellite Systems (GNSS).

**Space surveillance and tracking (SST):** multi-feed reception systems, SST antenna design, FMCW space radars.

**Intra-satellite wireless communications:** Transmissions in highly reflective environments, replacement of wired connections with wireless UWB links, SpW-to-wireless bridge, development of software interfaces to bridge the On-Board Computer-to-instrument connection, validation tests on dedicated laboratory testbed (TRL4).

**Wireless positioning and location:** outdoor and indoor positioning and location

**Smart antenna arrays:** SDR-based direction finding and beamforming (including UAV detection and localization).

**IntraSAT-Tech** received an award (with the "ROSA – ROMANIA 100" medal) from the Romanian Space Agency (ROSA) for the significant contributions in the development of the Romanian spatial activities.



### Team

**Prof. Tudor Palade**, Prof. Emanuel Puschita, Prof. Calin Munteanu, Prof. Catalin Popa, Prof. Ovidiu Pop, Assoc. Prof. Botond Kirei, Lect. Paul Dolea, Lect. Andra Pastrav, Assist. Cristian Codau, Assist. Rares Buta, Eng. Raluca Simedroni

### Representative projects

1. **RoNaQCI**, Romanian National Quantum Communication Infrastructure, DIGITAL-2021-QCI-01, 2023 – 2025.
2. **SIMoRF**, Intelligent System for RF spectrum monitoring, 05PSCD/2022, MApN, 2022-2025.
3. **ROSSA**, System for analysis and assessment of risks from outer space, PCCDI 36SOL/2021, 2021-2023.
4. **SDR4SST**, SDR based multi feed reception system for SST, 4000128680/19/D/CT, ESA, 2019-2022.
5. **HiSAT**, High throughput Wireless-SpaceWire Bridge for intra-satellite transmissions, 424PED UEFISCDI 2020-2022
6. **IntraSAT-Tech**, Centre of competence for wireless Intra-SATellite Technologies, STAR 115/2016, ROSA, 2016-2019, <https://intrasat-tech.utcluj.ro/drupal/node/2>
7. **RDAntenna**, Compact retro-directive wireless antenna network for wireless systems in IEEE 802.11 and IEEE 802.11 communication protocols, 6 SOL/2017, UEFISCDI, 2017-2020
8. **ASAPE**, Group of the AlphaSat Aldo Paraboni propagation Experimenters, Open forum of researchers performing propagation campaigns with the Aldo Paraboni payload and other satellite payloads at Ka band.

## Significant results

### Research Articles (The most representative publications of the past 5 years):

1. Buta R-C, Drobczyk M, Firschau T, Luebken A, Palade TP, Pastrav A, Puschita E, "SpaceWire-to-UWB Wireless Interface Units for Intra-spacecraft Communication Links", Sensors, 2023; 23(3):1363. <https://doi.org/10.3390/s23031363>.
2. Buta, R., Puschita, E., Kirei, B.S., Codau, C., Palade, T., Dolea, P., Pastrav, A., "Wireless-SpaceWire bridge for intrasatellite transmissions," International Journal of Satellite Communications and Networking, vol. 41, no. 5, pp. 477–498, Mar. 2023. doi: <https://doi.org/10.1002/sat.1479>.
3. Puschita, E., Pastrav A., Palade T., et al., "A UWB Solution for Wireless Intra-Spacecraft Transmissions of Sensor and SpaceWire Data", International Journal of Satellite Communications and Networking, John Wiley & Sons, Ltd., p. 1–21, 2019. <https://doi.org/10.1002/sat.1307>.
4. Dolea, P., Palade, T., Codau, C., Buta, R., Simedroni, R., Puschita, E., Cristea, O., Pastrav, A., "Parabolic Antenna Retrofit for Operation at 5.84GHz – Preliminary Feedhorn Design", 2022 International Workshop on Antenna Technology (iWAT), Dublin, Ireland, 2022, pp. 82-85. <https://doi.org/10.1109/iWAT54881.2022.9811062>.
5. Codau C., et al., "Implementation of an SDR-based FMCW Radar Receiver using LabVIEW NXG," 2022 International Workshop on Antenna Technology (iWAT), Dublin, Ireland, 2022, pp. 114-117. <https://doi.org/10.1109/iWAT54881.2022.9811016>.
6. Simedroni, R., et al., "Short-term Q-band Characteristics and Meteorological Data Statistical Analysis," 2022 International Workshop on Antenna Technology (iWAT), Dublin, Ireland, 2022, pp. 107-110. <https://doi.org/10.1109/iWAT54881.2022.9811087>.
7. Codau, C., Buta, R., Kirei, B., Pastrav, A., Simedroni, R., Dolea, P., Palade, T., Hedesiu, H., Puschita, E., "Design and Validation of a Wireless Bridge for Intra-Spacecraft Communications", 2021 44th International Conference on Telecommunications and Signal Processing (TSP), Brno, Czech Republic, 2021, pp. 386-389. <https://doi.org/10.1109/TSP52935.2021.9522609>.
8. Buta, R., Kirei, B., Codau, C., Pastrav, A., Farcas, C., Simedroni, R., Dolea, P., Palade, T., Puschita, E., "Design and Validation of a SpW Converter for Intra-Spacecraft Communications", 2021 44th International Conference on Telecommunications and Signal Processing (TSP), Brno, Czech Republic, 2021, pp. 381-385. <https://doi.org/10.1109/TSP52935.2021.9522627>.
9. Codau, C., Buta, R., Pastrav, A., Palade, T., Dolea P., and Puschita, E., "ULA Transmit Beamforming on SDR Platform," 2020 International Workshop on Antenna Technology (iWAT), Bucharest, Romania, 2020, pp. 1-2. <https://doi.org/10.1109/iWAT48004.2020.1570616261>.
10. Codau, C., Buta, R., Pastrav, A., Palade, T., Dolea P., Puschita, E., "An Overview of Digital Beamforming Implemented on SDR Platforms," 2020 International Workshop on Antenna Technology (iWAT), Bucharest, Romania, 2020, pp. 1-4. <https://doi.org/10.1109/iWAT48004.2020.1570609928>.
11. Codau, C., Buta, R., Palade, T., Pastrav, A., Dolea, P., Simedroni, R., Puschita E., "Experimental Evaluation of a Beamforming-capable System using NI USRP Software Defined Radios," 2019 18th RoEduNet Conference: Networking in Education and Research (RoEduNet), Galati, Romania, 2019, pp. 1-6. doi: 10.1109/ROEDUNET.2019.8909456.

### Case Study (National Instruments)

1. Direction-Finding System Deployment Based on the NI Platform, Buta, R., Codau, C., Pastrav, A., Palade, T., Dolea, P., Hedesiu, H., Balauta, B., Chirap, C., Puschita, E., Radiocommunications Research Group, Communications Department, Technical University of Cluj-Napoca and National Instruments Romania [Available online]: <http://sine.ni.com/cs/app/doc/p/id/cs-17758?niscr=RSS-featured-en>

### Significant solutions:

1. SDR-based multifeed reception system for SST.
2. SDR-based FMCW radar.
3. FPGA-based intra-satellite wireless communication modules designed to interconnect intra-spacecraft components.
4. Software communication stack for encapsulation of the SpaceWire packets.
5. SpW-to-UART bridge to interface On-Board Computer (OBC), payload and instrumentation.
6. Localization and positioning solution, smart antenna arrays for direction finding and beamforming.

### The offer addressed to the economic environment

Research & development	Custom SDR-based space surveillance and tracking (SST) solutions. Wide-FoV antenna systems for SST. Terrestrial, satellite and intra-satellite radio channel analysis and modelling. Adaptive beamforming techniques and MIMO systems applications.
Consulting	Consulting on satellite systems and radio channel modeling for intra-satellite and Earth-to-satellite communications, SST, smart antenna design, adaptive beamforming, and direction finding.
Training	<b>SICAS</b> Master (Integrated Communication Systems for Special Applications) including: Wireless systems, Interferences and electromagnetic compatibility, Satellite communications systems, Measurement of radio systems, Radio networks planning. <a href="http://master-sicas.utcluj.ro">http://master-sicas.utcluj.ro</a>

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