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5G for a Better Tomorrow: Protecting Lives and the Environment in Riga and Turin
Grant Agreement No 101133716

5G4LIVES D6.3

INITIAL BUSINESS AND EXPLOITATION PLAN

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5G4LIVES
D6.3 Initial Business and Exploitation Plan

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5G4LIVES ABSTRACT

In an era where technology is advancing at an unprecedented pace, the project takes centre stage as an initiative committed to harnessing innovation for the greater good. This project unfolds its transformative vision across two distinct geographic clusters, Latvia and Italy. It strategically leverages 5G connectivity alongside cutting-edge technologies such as Unmanned Aerial Vehicles (UAVs or drones) and alternative hydrogen power. With a dual mission of enhancing public safety and environmental health, the project unfolds a narrative where data-driven forecasting and real-time aerial situational awareness become the bedrock of a more secure, efficient, and sustainable future.

At its core, the project seeks to enable optimal emergency management and data-driven forecasting, a mission encompassing the entirety of public safety. Through the dynamic fusion of 5G connectivity and UAVs, this initiative aims to provide real-time aerial situational awareness and automatic vulnerability assessment for at-risk areas. The project's scope extends beyond traditional rescue operations, pushing the boundaries of innovation to safeguard both human lives and the environment.

The project in Latvia involves using drones and 5G technology for monitoring and rescue operations, especially at Vecaku Beach and Kisezers Lake in Riga. This approach aims to enhance police efficiency, particularly in challenging terrains. In Turin, the focus is on developing a 5G-enabled service for situational awareness and vulnerability assessment to counter natural disaster threats. This includes testing anti-drone hacking technology, integrating satellite data, and improving pilot-drone command for better emergency response. The project also includes research in Riga on safety protocols and procedures for urban drone operations and beyond-visual-line-of-sight (BVLOS) flight methodologies with EU-wide relevance. A significant aspect of the project is to engage in extensive communication to inform and educate local, national, and EU networks about these technological solutions.

By leveraging 5G and drones, the project promises quicker and more effective emergency response, addressing staff shortages in law enforcement and expanding their skill set. In Latvia, the use of drones and 5G connectivity will empower law enforcement to intervene more swiftly, addressing staff shortages, and expanding the skill set of police officers. In Italy, the project will mitigate the threat of natural disasters and test innovative anti-drone hacking technologies, leading to more efficient emergency responses. Additionally, developing safety protocols, and procedures for urban drone flights, and validating BVLOS flight methodologies will set new standards for public safety and security. the project emphasizes community involvement and knowledge sharing, ensuring that the benefits of these technological advancements extend beyond immediate emergency management to foster a more resilient and informed society

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ABBREVIATIONS AND ACRONYMS

5G	The Fifth Generation of Wireless Cellular Technology
AI	Artificial intelligence
BVLOS	Beyond-visual-line-of-sight
D	Deliverable
DMP	Data Management Plan
DOI	Digital Object Identifier
EU	European Union
EUR	Euro
FAIR	Findable, Accessible, Interoperable and Reusable
FWA	Fixed wireless access
ID	Identification
IP	Internet Protocol
IPR	Intellectual Property Rights
ISSN	International Standard Serial Number
LEP	Legal and Policy Officer
LTE	Long-term Evolution
Mbps	Megabits per second
PII	Publisher Item Identifier
RM	Riga Municipality
SGEI	Socially Responsible Public Services
STEM	Science, Technology, Engineering, and Mathematics
T	Task
TB	Terabyte
UAV	Unmanned Aerial Vehicles
WP	Work Package

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EXECUTIVE SUMMARY

D6.3 "*Initial business and exploitation plan*" describes the initial approach to exploiting the results of the 5G4LIVES project, including potential commercialization opportunities and the identification of potential markets for the project's solutions. It outlines the business model for the project and identifies the key actors and their roles in the value chain. The document also includes an overview of the project's intellectual property rights and an analysis of the regulatory and legal frameworks that may affect the project's commercialization. Due in Month 10, it focuses on the initial strategies for exploiting the project's results. This deliverable underpins the project's sustainability and market impact, laying the groundwork for Milestone 14.

INTRODUCTION

This introduction describes a high-level analysis of the market prospects for drones, 5G and security services.

The global drone market is experiencing strong growth, with an estimated value of around €48 billion in 2024 and a forecast to reach €471 billion by 2030. The main applications include construction, agriculture, energy, entertainment, and law enforcement. In Italy, for example, the professional drone market reached €145 million in 2023, with a 23% growth compared to the previous year. The outlook is very positive, with further expansion expected in the coming years, especially in the segment of aerial operations and advanced air mobility.

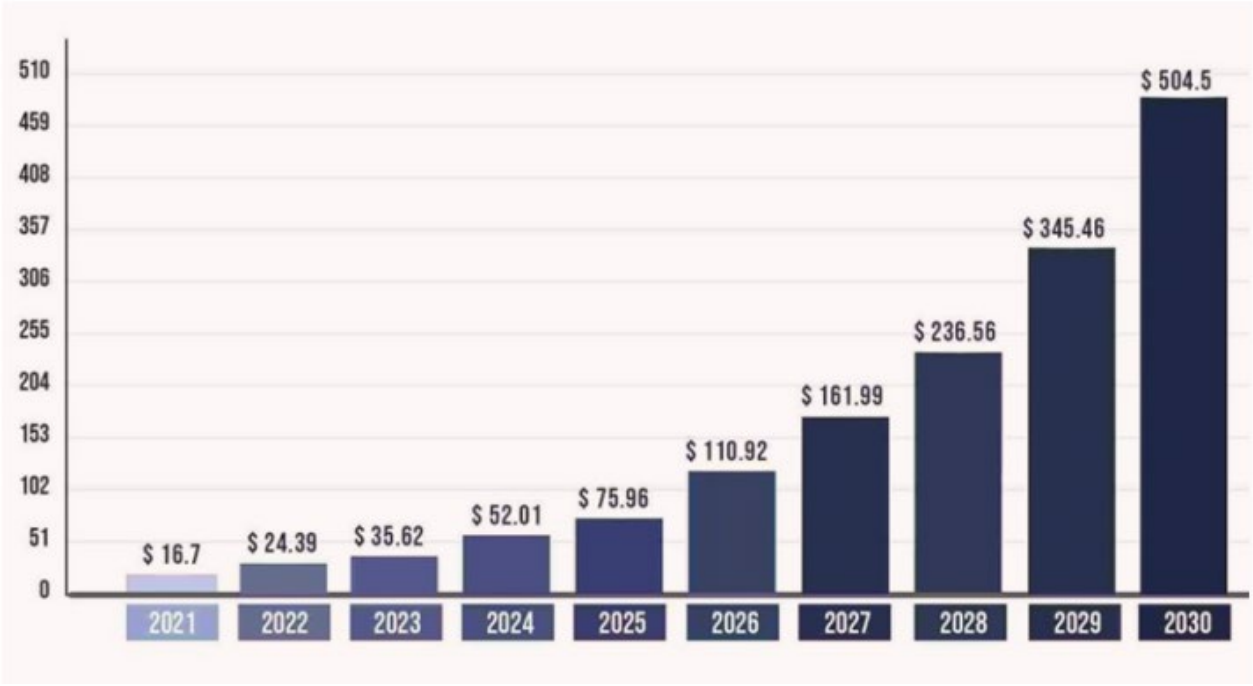

Fig.1

Commercial Drone Market Size by application 2021 to2030

Source: www.precedenceresearch.com

5G represents one of the most revolutionary technologies of our time, with a significant impact on various sectors. Its implementation is accelerating globally, with a forecast to cover 45% of the world's

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population by 2025. 5G offers very high connection speeds, low latency, and the ability to connect a huge number of devices, making it ideal for applications such as the Internet of Things (IoT), autonomous vehicles, smart cities, and augmented/virtual reality. This will lead to new market opportunities and innovative business models.

The security services market is continuously evolving, driven by the growing need for protection against cyber and physical threats. Digitalization and the increase in cyber threats have led to greater demand for advanced security solutions. The global cybersecurity market is expected to reach €226 billion by 2026. Emerging technologies such as artificial intelligence, machine learning, and blockchain are playing a crucial role in improving threat detection and response capabilities. These sectors are set to grow significantly in the coming years, offering numerous opportunities for businesses and investors.

The 5G Market Applied to Drones and Public Safety presents significant potential, with various opportunities and challenges.

Potential of 5G for Drones:

1. Improvement of Operations: 5G offers ultra-low latency and greater data capacity, essential for real-time control of drones. This is particularly useful for complex operations such as surveillance, package delivery, and search and rescue missions.
2. Increased Safety: 5G connectivity allows for more reliable and secure communication between drones and control stations, reducing the risk of accidents and improving air traffic management.
3. Technological Innovations: 5G facilitates the use of advanced technologies such as artificial intelligence and real-time data analysis, enhancing the capabilities of drones in various sectors.

Applications in Public Safety:

1. Surveillance and Monitoring: Drones equipped with 5G can be used for real-time surveillance of urban and rural areas, improving emergency response and public safety management.
2. Emergency Interventions: In the event of natural disasters or accidents, 5G-connected drones can provide real-time images and data to rescue teams, facilitating faster and more effective interventions.
3. Traffic Management: Drones can monitor traffic and provide real-time data to improve traffic management and reduce congestion.

Future Prospects:

The European Union is investing significantly in 5G, with the goal of ensuring complete coverage by 2030. This investment, combined with technological innovation and collaboration between the public and private sectors, could transform the way drones are used for public safety, making operations more efficient and secure.

Challenges and Considerations:

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1. Infrastructure: The spread of 5G requires robust and widespread infrastructure. In some areas, especially rural ones, significant investment may be needed to ensure adequate coverage.
2. Regulation: The regulation of drone use and 5G networks must be updated to address new security and privacy challenges.
3. Cybersecurity: The security of 5G networks is crucial, as any vulnerabilities could be exploited for cyberattacks, putting public safety operations at risk.

Main Challenges:

The implementation of 5G in drones presents several challenges that must be addressed to fully exploit the potential of this technology. Here are the main ones:

1. Infrastructure
    - Coverage: The 5G network requires widespread and uniform coverage, which can be difficult to achieve in remote or rural areas. The lack of adequate infrastructure can limit the use of drones in these areas. Moreover, the current mobile radio network is designed and structured to ensure the best coverage conditions on the ground, not in the sky. This aspect must be considered in projects involving the mobile radio network to connect flying objects.
    - Costs: The installation and maintenance of 5G infrastructure are expensive. The necessary investments can be an obstacle, especially for small and medium-sized enterprises.
2. Regulation
    - Norms: Current regulations on drones and telecommunications must be updated to include the specifics of 5G. This process can be long and complex.
    - Privacy and Security: The use of drones for surveillance raises privacy concerns. A clear regulatory framework is needed to ensure that the data collected is managed securely and respectfully of privacy.
3. Cybersecurity
    - Vulnerabilities: 5G networks, being more complex and connected, can be more vulnerable to cyberattacks. Protecting communications between drones and control stations is crucial to avoid interference or unauthorized access.
    - Data Protection: The amount of data transmitted by drones can be significant. Ensuring the security of this data is essential to prevent theft or manipulation.
4. Interference and Compatibility
    - Electromagnetic Interference: 5G uses frequencies that can interfere with other electronic devices. It is important to manage these interferences to avoid operational problems.
    - Compatibility: Drones must be compatible with existing 5G networks. This may require hardware and software updates, increasing costs and implementation complexity.
5. Social Acceptance
    - Public Perception: The use of drones, especially for surveillance, can be viewed with suspicion by the population. It is important to educate the public about the benefits and safety measures adopted to gain wider acceptance.
6. Technical Capabilities

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- **Battery and Autonomy**: The use of 5G can increase the energy consumption of drones, reducing their autonomy. Developing more efficient batteries is an ongoing challenge.
- **Air Traffic Management**: With the increase in the number of drones, an effective system is needed to manage unmanned air traffic, avoiding collisions and ensuring safe operations.
- **Mobile Radio Network**: The current mobile radio network is designed and structured to ensure the best coverage conditions on the ground, not in the sky. This aspect must be taken into account in projects involving the mobile radio network to connect flying objects.

Addressing these challenges requires **collaboration between governments, technology companies, and research institutions**.

Benefit introduced by 5G

Companies and Analysts report that the security segment holds the largest market share in terms of applications. Drones are highly used for surveillance border control and public safety which provides real time data and enhanced situational awareness; on the other hand the fastest-growing application segment is environmental monitoring.
The major constraint is the regulatory environment.

The benefits introduced by 5G are fundamental to unlock the application potential of remotely controlled drones in BVLOS, offering unprecedented speed, low latency, and high reliability. Drones equipped with 5G connectivity can harness these capabilities to transmit and receive data at remarkable speeds, facilitating real-time communication and seamless control. Crucially, the minimal latency afforded by 5G reduces the time lag between command inputs and drone responses, ensuring smoother flight operations and empowering tasks that demand rapid decision-making, such as aerial inspections or emergency response. Moreover, the expanded bandwidth capacity of 5G enables drones to swiftly transmit large volumes of data, unlocking opportunities for applications like high-definition aerial imaging, live video streaming, and remote monitoring, where data-intensive tasks are prevalent.
There are many applications of drones in the security and surveillance sector, just to name a few:

- Advanced monitoring and situational awareness
- Rapid Response and Threat Detection
- Enhanced Perimeter Security and Investigations
- Augmented Analytics and Intelligent Insights
- Improved Communication and Collaboration

Another important boost on applications of drones comes from Law Enforcement adoptions all around the world. This could be an important driver to boost the potential applications of drones and to push regulators to introduce some changes in rules, so to unlock a huge amount of benefits for all stakeholders: people, municipalities, industries.

Thanks to AI, the integration and analysis of data combined with the development of 5G allows data sharing at unprecedented rates, supporting hyper-connected environments for improved emergency response and citizen services.

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With the right approach, 5G can revolutionize the use of drones, improving public safety and opening new market opportunities.

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1. INITIAL BUSINESS AND EXPLOITATION PLAN

1.1. IDENTIFICATION OF POTENTIAL MARKETS

In a worldwide scale the UAV industry has grown considerably due to technological advancements. Therefore, the introduction of 5G network has even further increased UAV deployment in various application domains. In the case of this Project **the EU market** is considered since the overall analysis of regulatory framework etc. is that of the EU. While the EU territories become more and more connected through the 5G network, not many applications in terms of product use cases are noticeable. Therefore, the use of 5G UAVs in the Project use-cases in Italy and Latvia is a unique demonstration of the technological potential.

5G networks will be able to support the route planning, remote control, identification and location tracking of large numbers of UAVs, while also enabling operators to view video streams in real-time. Even though, the designed 5G UAV is not a result of the Project the use of it will indicate positive use-cases for this type of UAV which will benefit the UAV manufacturers. Further on, the UAV will also be tested in a BVLOS flight that widens the use-case compatibility.

BVLOS operations have gained significant attention in recent years, for their higher degrees of intelligence that brings several benefits such as greater efficiency and minimization of human risks.

Lastly, the developed software, AI solutions and operational schematic for the rescue operation developed by Ltd "LMT" and Riga Municipal Police have potential to be upscaled all over Europe. Not only highlighting other police forces around Europe as potential target markets, but every Municipal organization as well which includes, for example, firefighter units. The Project solutions will not only potentially highlight better results for certain emergency service tasks but also show clear savings from the embedded processes.

Market diffusion and Commercialization roadmap

The 5G network deployment scalability potential, as 5G4LIVES point of view, could be seen in terms of future deployment of 5G SA network to enable a dedicated Slice to ensure performances to guarantee BVLOS drones flight use cases nationwide, not only, as obvious, under a 5G Private Network provided where needed and where the area is out of (commercial) coverage.

At this point in the project, 5G4LIVES doesn't have a specific plan of investment on the network to support drones flight in consideration of:

- The network is built to provide coverage to people and devices (IoT and IIoT) on the ground.
- The flight of drone in BVLOS are subject to flights regulations and restrictions by Authorities that today are limiting the use case scenarios.

LMT is actively involved in several projects, including 5G4LIVES, which focuses on flights. Discussions with potential clients—such as municipalities, law enforcement agencies, large corporations, and state-owned enterprises—have revealed a clear business case for automated BVLOS flights equipped with AI and machine vision. These companies are seeking innovative ways to optimize resources, reduce costs, save time, conserve fuel, and meet CO2 reduction targets. Automated BVLOS flights address many of these needs.

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As the largest telecommunications provider in Latvia, LMT continues to invest in 5G infrastructure annually, laying the foundation for BVLOS operations. Furthermore, LMT's expertise in deploying 5G private networks opens significant export opportunities, especially for integrated solutions like AI-driven BVLOS flights operating over secure, private 5G networks. By adding SIM cards to drones, LMT can extend operational range, with distance limited primarily by battery capacity and not by its WiFi range.

While the technology itself is viable, current regulatory and bureaucratic hurdles—such as legislation—remain the primary challenges. To address these, LMT is working closely with the Civil Aviation Agency (CAA) to resolve these issues and bring BVLOS solutions into mainstream use.

1.2. Methodology for validating and planning BVLOS flights

A dedicated evaluation of the potential market has to be done for the methodology for validation and planning of BVLOS flights, one of the contributions of the 5G4LIVES project. The methodology will be also integrated into a Web-application to allow the use to UAS operator. This tool is a promising decision-making tool useful to plan and validate safe flight missions, even in urban areas.

The tool is useful not only for UAS operators but also for National Aviation Authority that can exploit the tool to validate BVLOS flights and, therefore, grant the permission to fly. Obviously, this is possible only if the National Aviation Authority approves the methodology.

The methodology adopted is based on a high-fidelity risk assessment approach that is compatible with the SORA (Specific Operations Risk Assessment). For this reason, the developed tool will be valid and exploitable at the European level.

The developed tool for plan, validate and execute BVLOS flights may be also promising for a commercial exploitation. In fact, this tool is novel and unique at the state of the art and on the market.

Obviously, the 5G4LIVES project aims to develop a "prototype" (demonstrator) of the tool to demonstrate its effectiveness and functionalities. However, further development and enhancement aimed at producing a product has the potential to realize a commercially promising solution.

On the market, there are no similar tools to plan BVLOS flights. Most of the UAS operators make use of ground control station (GCS) software to plan a flight mission, by manually planning a waypoint-based path on a map or with some simple automatic planning capabilities. GCS software, such as QGroundControl or Mission Planner, to name a few, offer some capabilities to provide coverage planning, monitoring applications and to offer an intuitive interface with the drone autopilot. However, they don't offer any support for the UAS operator to perform a risk assessment, plan a safe path and for conducting the SORA.

A novel Web-tool, called SAMWISE, is provided by EuroUSC Italia. As defined by EuroUSC, it is "an easy web-tool supporting SORA methodology". The tool permits to perform a SORA following a wizard and including some basic details about the flight missions. However, SAMWISE includes the SORA methodology without any support about the mission planning and validation of the path.

Similarly, SORA Mate implements a risk assessment tool based on the SORA, also offering support to UAS operators.

In the literature, there are several SORA-based tools that offer a simple multi-step and guided process to evaluate each step of the SORA process. However, they are tools developed for research projects and not made available on the market to UAS operators.

After this preliminary analysis, it is clear that the proposed tool for planning and validating BVLOS flights is unique on the market.

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1.3. VALUE CHAIN/ KEY ACTORS

The primary buyers in the value chain are typically government entities:

Local Law Enforcement Agencies: This includes city and county police departments or internal security guards (fireman, etc.). They directly purchase equipment and technology to enhance the safety of their officers and the public. In some cases, procurement will be carried out by municipality or the Ministry responsible for the internal security of the country. There emergency response agencies like fire departments and search and rescue teams would be involved in training on drone usage and integrating them into their rescue protocols.

Application can be also targeted to following institutions:

Military and Defense Organizations: These organizations require specialized equipment for their personnel, particularly in combat and rescue situations.

Emergency Medical Services (EMS): EMS providers, such as ambulance services and fire departments, may purchase life-saving equipment and technology to improve patient care.

Border Patrol and Customs Agencies: These agencies may acquire advanced surveillance and detection equipment to protect borders and prevent illegal activities.

In addition to government agencies, some private security companies and humanitarian organizations may also purchase life-saving solutions to protect their personnel and aid in disaster relief efforts.

Within the value chain would be following stakeholders, which each have role in the economic activities of the project outcomes:

Key actors in the Drone Value Chain:

1. Drone Manufacturers: These companies design, develop, and manufacture drones for various applications. They would be responsible for supplying the drones with the necessary features like long-range capabilities, night vision technology, and payload capacity for rescue equipment. They also insure drone management systems and compliance with reporting requirements for air traffic control. These companies create software for drone flight control, data processing, and mission planning.
2. Machine Intelligence Software Developer: they would develop specialized software for autonomous night-time operation, real-time data analysis, and communication with emergency services.
3. Telecom Providers: These companies provide the communication infrastructure for drones, including cellular networks and future 5G networks. In each market they would be crucial for setting up a dependable 5G network with low latency and high bandwidth for seamless communication and data transmission during rescue missions as well as providing secure network for autonomous drone operations.
4. Government Agencies: Regulatory bodies like ENAC (IT) ENAV (IT), CAA (LV) EASA (EU), set guidelines for drone operation and airspace management. These bodies work together to ensure that drone operations are safe and compliant with current regulations.

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5. Sensor Manufacturers: These companies provide sensors like thermal cameras, LiDAR (Light Detection and Ranging), and night vision cameras for drones. They would equip the drones with specialized sensors for search and rescue operations in low-light conditions.
6. Insurance Companies: They offer insurance policies covering drones for liability and damage. They would work with the operating organization to develop customized insurance plans for emergency drone operations.
7. Public: This includes the general population who might benefit from the improved rescue capabilities provided by the project. Public awareness campaigns could be conducted to educate citizens on the use of drones in emergencies.

The main product commercialisation team would be either product developers (e.g. Software developers) or Drone manufacturers. Since the drones need good use cases, both software and hardware owners have their primary interest in reaching end users and integrating their products into other security operations.

Municipality of Riga and Torino as pilot organisers will assist with demonstration and examples of the real implementation of the solution as well as helping to assess its effectiveness.

1.4. Customer Types

As previously mentioned, the methodology can be exploited by different types of costumers:

- UAS operators: represent the main customers. The tool is designed to support a UAS operator to conduct a risk assessment and to conduct a risk assessment procedure. The output of the tool is a documentation that can be submitted to the National Aviation Authority for the authorization process.
- National Aviation Authorities: at present, National Aviation Authorities in Europe, such as ENAC in Italy, have to analyze each flight authorization request by reading large documents and interpreting assumptions and safety procedures adopted by the UAS operator. In fact, even if the SORA is a multi-step process, there is not a standard for drafting the documentation for an authorization request. The adoption of a tool for risk assessment and safe path planning and validation can help the NAAs to speed up the authorization process. The analysis of the authorization request cannot be avoided, but the use of a well-known methodology can streamline the evaluation.
- U-Space Service providers (USPs): according to the U-Space framework proposed by EASA, the role of U-Space Service Provider (USP) is to offer U-Space services to UAS operators. For example, the main USP in Italy is represented by D-Flight. For this role, in EU Country there may be several USPs that can also offer additional services. The adoption of the tool developed within the 5G4LIVES can be one of these additional services.

1.5. PRELIMINARY MARKETING STRATEGIES/ACTIVITIES

At the date of this document, the consortium is preparing a preliminary marketing strategy in the meanwhile that actual regulatory, technology and feasibility constraints will be solved so to evaluate the real market potential for this 5G use case.

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The main activities that consortium has planned for the next year are related to the communication and promotion of the 5G4lives project in the main locations where to talk directly with the stakeholders, in terms of importance, objectives, results, benefits and prospectives of the relevant contribution of this trial in everyday people lives. These locations are both public and business contests.

In Italy, as we know, the geomorphology of the country, the urbanization of valleys, a huge orography, there's a natural vulnerability in facing emergency situations due to flooding, particularly disaster caused the climate changings. For those reasons is particularly urgent to intervene to raise awareness, with a bottom-up approach, at local level, directly with the Majors of the municipalities, that are also the head of Civil Protection, so they are on the first line when emergencies situations occur.

All partners are sponsor partner in specific events/contests where it will present and will emphasize the importance of this project: one is a nationwide event (ANCI event), while the others are regional events located in northern and southern Italy. These events involve two among the main stakeholders in the value chain of these future services: Municipalities and Industries:

1. Evento nazionale ANCI (Assocciazione Nazionale Comuni Italiani): is an annual event attended by the institutional representation (the Major of the Municipality) of italian municipalities (7.904). It is the ideal place where to raise awareness of the Majors, the "head of local civil protection", on the opportunities and benefits brought by the 5G use cases to monitor the territory and to face emergencies situations.

3. City Vision: it is platform of events, contents, network, to contribute to the smart transformation of the territories. The City Vision community includes public administrators, PA officials, businesses, organizations, professionals, researchers, innovators. City Vision is the community of smart territories to tell and experience the smart transformation of the cities and villages of Italy.

2. Vision Alps: it is the first B2B initiative in Italy dedicated to the “Digital Transformation of Alps” and aims to provide public and private operators in the Alpine ecosystem with a tool to delve deeper and discuss and then decide which innovative projects and investments to develop in the territory. It provides the local audience with innovative solutions that can also be used concretely for the development of digital and sustainable innovation, through individual events in the territories (VISIONALPS FORUM) and online meetings (VISIONALPS MEETING).

4. Digital Innovation Hub-Campania (South-Italy): the Campania Digital Innovation Hub is a consortium company formed by the Campania Territorial Associations of Confindustria (Industrial Union), and by its members: Tim, WindTre and NetGroup. The aim of the consortium is promoting various services: Information and training, Support for businesses related to digital transformation projects, Technical and financial consultancy, Mentoring and training of managers, Support in accessing financing.

Consortium is participating in events already to introduce 5G4LIVES project and UAM related topics,

The forum "5G Techritory" took place between October 30 and October 31, 2024 at the ATTA conference centre at 60 Krasta Street, Riga. It gathered a total of more than 1800 participants in person and online, of whom 108 were speakers in panel discussions. A total of more than 40 countries were represented, 26 panel discussions were organized and 22 co-creation events took place. A panel discussion "5G systems and BLVO'S monitoring to protect lives and public health - 5G4Lives" was dedicated to the Project. The

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discussion was held by project partners (VEFRESH, LMT, Riga Municipal police and Riga Digital Agency) representatives as well as by a Latvian Civil Aviation Agency representative. The discussion covered the following topics:

- Introduction to the 5G4LIVES project – how the project strategically combines 5G connectivity with cutting-edge technologies such as enabled monitoring of drones (UAVs or drones) and of alternative hydrogen charging overturns.
- How 5G-enabled real-time monitoring services can revolutionize emergency response and healthcare, offering faster, more accurate interventions that can save lives.
- The critical need for legislation and planning for urban air mobility, focusing on the safe and efficient integration of drones and air ambulances into city infrastructures.
- The role of innovation procurement in driving the adoption of cutting-edge 5G technologies, ensuring that public health and safety services are equipped with the best possible tools.

Session available publicly on Youtube: https://www.youtube.com/watch?v=TxuKbi1eRDU

5G4LIVES project partners showcased the project at the Smart City Expo World Congress 2024 in Barcelona from November 5-7. This prestigious event attracts city representatives, industry leaders, researchers, and innovators from around the globe.

Riga city hosted a panel discussion at Tomorrow Mobility Agora stage "Urban Air Mobility by 5G Solutions: Accelerating Drone Services". The discussion took place on November 5 from 15.45 until 16.30 at Hall2, Tomorrow.Mobility Agora.

The panel brought together international experts to share knowledge, use cases and best practices to accelerate drone services and urban air mobility using 5G solutions. Discussion focused on enhancing 5G connectivity in urban spaces and highlighted the importance of city roles and cross-border collaboration. The session aimed to foster EU-wide innovation and regulatory harmonization, driving advancements in smart city technologies and sustainable urban development. Panel explored the future of urban air mobility and the integration of 5G technologies, demonstrating how cities can play a pivotal role in the development of innovative, smart transportation systems. 5G4LIVES project enables all of the mentioned above.

Also, it is important to highlight international cooperation projects that implement critical aspects of UAM, including BVLOS flights, tools for a solid UAM strategy, city planning practices for landing site and airspace management, and scaling city-owned drone operations in a multimodal transport system. Additionally, citizen involvement, increasing public officials' capabilities, and measuring public acceptance are crucial to this work. That is why 5G4LIVES project consortium is closely following other UAM related projects and one of them is CITYAM: a joint initiative between Finland, Latvia, Estonia, Poland, Germany, and Sweden aimed at improving airspace management for emerging urban air mobility and scaling drone operations. Knowledge sharing and best practice sharing is a very important aspect that helps to drive innovation process within specific projects but also on a larger scale.

The 5G4LIVES project was introduced at the 5GSC Community Conference in Brussels in October 2024. The council of experts was able to inquire about the project's objectives, approach, and completed steps. The project concept served as an inspiration for both experts and other developers of 5G technology. The overarching conclusion of the presentation was that the project has a significant influence on the application of 5G technology and the promotion of BVLOS flights in comparable scenarios, such as large European cities

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with dense air traffic. The future of BVLOS flights in Europe will be significantly influenced by the blueprint and roadmap of the project, which are the only prospective deliverable, according to the experts.

Professional publications which engage innovators into discussions – raise of interest from other cities, municipalities and security organisations.During academic conference "the 65th International Scientific Conference of Riga Technical University on Power and Electrical Engineering RTUCON2024" a publication entitled "Harnessing 5G Connectivity and UAVs for Enhanced Public Safety" was presented. It raised interest from the audience about the legal framework and potential technical solutions that could be used by other drone related projects.

Most of events attended this year are annual and team will continue presenting the progress to other stakeholders within already mentioned platforms and explore other high impact industry events to provide information and results of the project.

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2. REGULATORY AND LEGAL FRAMEWORK POTENTIAL MARKETS

1.6. IPR STRATEGY

The comprehensive plan that outlines how will the Project manage, protect, and leverage its intangible assets, such as patents, trademarks, copyrights, and trade secrets, is outlined in Consortium Agreement Article 8 and Grant Agreement Article 16.2 and its Annex 5. Both Agreements govern that the created assets are owned by the Party that generates them. In cases of joint ownership of results all the involved parties ensure that there is common understanding about who are the joint owners of every joint result and agree the level of contribution of each of the joint owners.

In cases of conflict, the Project consortium has agreed on this resolution mechanism:

1) Initially conflicts are mediated by the Project Steering Group.
2) If conflicts persist, they are escalated to the Project Supervisory Board.
3) If conflicts are unresolved, Article 11.8 of the Consortium Agreement and Article 43 of the Grant Agreement is applied for resolution.

Since the 5G UAV is facilitated through a procurement by a third party, the ownership of this specific UAV design is patented by the third party. The software code and AI solutions for the possibility to conduct a BVLOS flight will be created by Ltd "LMT", hence, the copyrights for this operator system would stay with the Latvian company. The safeguard of processes, operational methods and user manuals would fall into each pilot location's responsible authority. For example, in the case of Riga the operational blueprint on using 5G drones with BVLOS flights to ensure safety in public beaches would be marked as a trade secret in the property of Riga Municipal Police.

Note: The IP strategy agreed in the Grant and Consortium agreement emphasizes clear communication, structured conflict resolution, and comprehensive rights management to protect and leverage individual and joint ownership results effectively.

Regarding the BVLOS methodology, the conditions set out in the grant and the consortium agreement are applied. It should be noted that the methodology is based on the research work already developed by the Politecnico di Torino in [1-5], which represents the background of the methodology. However, the Web-app tool implementing the BVLOS methodology will be developed in the present project, representing one of the outcomes of 5G4LIVES.

1.7. REGULATORY CONSTRAINTS IN TARGETED MARKETS

The prospects for the commercialization of the project must consider the regulatory framework, summarized below:

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Regulatory and Legal Framework for the Use of Airspace:

1. International Regulation:
    - ICAO: The International Civil Aviation Organization (ICAO) sets global standards for the safe use of airspace, including drones. It is developing a traffic management system for drones (UTM) to ensure safety.
    - EASA: The European Union Aviation Safety Agency (EASA) has issued regulations that distinguish between categories of drone use (open, specific, certified) based on the level of risk.

2. Regulations in Italy and Latvia:
    - ENAC: The Italian Civil Aviation Authority (ENAC) regulates the use of drones in Italy, distinguishing between recreational and professional use. The rules include height limits, the obligation to keep the drone in sight, and restrictions on sensitive areas.
    - In Latvia, drone regulations are primarily governed by the Latvian Civil Aviation Agency (CAA) and also follow the guidelines of the European Union Aviation Safety Agency (EASA).
    - Privacy: The European GDPR imposes strict requirements for the protection of personal data collected via drones, such as obtaining consent from data subjects and minimizing data collection.
3. Safety and Liability:
    - Drone operators must be insured against damage to people or property. Liability in case of accidents falls on the operator, who must comply with safety regulations.

Regulatory and Legal Framework for the Use of 5G:

1. European Electronic Communications Code: This code, closely linked to the 5G action plan, sets the conditions for the allocation and availability of radio spectrum, promoting the deployment of small cells and addressing sectoral issues that hinder the spread of 5G services.
2. Standardization and Research: The EU collaborates with industry through the 5G Public-Private Partnership (5G-PPP) to lead global 5G research and standardization. This partnership has positioned Europe at the forefront of 5G technology research and development.
3. Security and Cybersecurity: The security of 5G networks is a priority. The EU has established guidelines to ensure the security of 5G infrastructure, addressing cybersecurity risks and protecting public health.
4. Investment Incentives: Venture capital funds and other support measures have been created to encourage investment in 5G infrastructure, promoting innovation and the competitiveness of the European industry.

These elements constitute the regulatory and legal framework guiding the implementation of 5G in Europe, with the aim of ensuring an inclusive and resilient digital transformation.

Regulatory and Legal Framework for categorizing drones and BVLO'S flights:

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The EU drone regulation adopted a risk-based approach, in which three risk-based categories of UAS operations are identified: Open, Specific, and Certified:

The Open category refers to the lower-risk civil drone operations in which the safety is ensured by the drone operator satisfying some operational requirements: all the operations are conducted in VLOS (Visual Line Of Sight) avoiding to fly over uninvolved people, except with harmless and low-mass drones (with MTOM < 900g). This category includes three subcategories, namely A1 (Fly over people but not assemblies of people. With MTOM < 900g), A2 (Fly close to people. with MTOM < 4kg), and A3 (Fly far from people. With MTOM < 25kg). Operational risks in the Open category are considered low and, therefore, no operational authorisation is required before starting a flight.

The Specific category covers riskier drone operations, where safety is ensured by the drone operator by obtaining an authorization from the competent National Aviation Authority (ENAC in Italy) and CAA (Civil Aviation Agency) in Latvia before starting the operation. To obtain the authorization, the operator has to conduct a risk assessment, which will determine the main requirements necessary to conduct a safe operation. This category includes most of the civil operations that do not fall within the Open category, i.e. BVLOS (Beyond Visual Line Of Sight) flights, with a MTOM greater than 25kg, flying over populated areas, flying in non-conventional airspace, etc.

As previously defined, in order to fly within this category is required to obtain an authorization. Practically, the complexity of obtaining the authorization depends on the level of risk involved in the operation and we can identify three different scenarios:

1. Conducting an operation based on Standard Scenarios (STS), i.e. a predefined operation that can be conducted after submitting a declaration to the National Aviation Agency and without requesting and waiting for the authorization.
2. Conducting an operation based on a Predefined Risk Assessment (PDRA) scenario, i.e. a predefined scenario (with a greater risk than STS) on which a risk assessment is already conducted by the National Aviation Authority. The PDRA requires the authorization from the National Aviation Authority, but with a simplified process. In fact, the NAA already know the PDRA scenario, and the authorization process should be faster.
3. Conducting an operation not covered by STS and PDRA scenarios. This is the most complex scenario in which the drone operator has to perform a risk assessment based on the SORA (Specific Operation Risk Assessment) process. The authorization for conducting the operation is granted after an in-depth analysis of the SORA from the NAA. The authorization process is more complex and slower. It often takes several iterations with NAA to meet safety requirements and conduct flight operations safely.

The Certified category covers operations with high risks and requires the certification of the drone, as well as the licensing of the pilot. This category includes operations of passenger transport (air-taxi), dangerous goods, or unmanned general aviation aircraft. This category is reported for completeness, but in the following paragraphs it will never be taken into consideration, given that the use cases of the 5G4LIVES project do not fall into this category.

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The BVLOS flight can be conducted only within the Specific category. Nowadays, conducting BVLOS flights is a challenge due to the requirements imposed by NAAs. The scenario is even more challenging if you want to operate in urban and sub-urban environments, as in the 5G4LIVES project.

According to the European Regulatory framework, within the Specific category the BVLOS flight can be conducted in the following scenarios:

1. European Standard Scenario STS-02: BVLOS flight operation (up to 1km) over controlled ground area, i.e. no uninvolved people in the operational area. This scenario requires the use of a drone with the C6 Identification Label.
2. European PDRA-S02: BVLOS flight operation (up to 1km) over controlled ground area

3. European PDRA-G01: BVLOS flight operation with airspace observer (technically is a EVLOS) in an uncontrolled airspace over sparsely populated areas.
4. European PDRA-G02: BVLOS flight operation within the C2 link range (radio line of sight) in reserved/segregated airspace over sparsely populated areas.
5. European PDRA-G03: BVLOS flight operation within the C2 link range (radio line of sight) operating close to obstacles over sparsely populated areas.
6. Other scenarios: any other scenario can be taken into consideration but requires a risk assessment using the SORA process.

In the list above, only the main features that concern the operation in BVLOS are shown. Each scenario has different requirements of the drone, operator and adoption of different risk mitigations that must be ensured to execute a safe operation.

At the moment BVLOS operations are only permitted over controlled ground areas ensuring that in the event of an accident, no uninvolved people are within the operational area.

Actual limits for commercial purposes:

As regards the current Italian regulatory framework, it is necessary to make a premise and distinguish between the world outside the core business of WindTre and LMT as a Telco operators, i.e. the one relating to the flight authorizations required by ENAV/ENAC, and the one inside the product sector of, specific to the mobile telephony services (core business) that it provides, i.e. the regulation of the assignment of usage licenses for the frequencies used in 5G networks.

The current limitation of drone flights in BVLOS represents to date the main limit in the use, for commercial purposes, in public areas (with the presence of people, buildings, vehicles and infrastructures) of services based on the use of drones.

With regards to the use of 5G frequencies for public use, partners believes that a review of the regulation by MIMIT (Ministry of Business and Made in Italy, owner of 5G frequencies, licensed to telecommunications operators for the provision of public telephony services) is desirable, with the same orientation as already done in the rest of the world, with the dedicated assignment of portions of RF spectrum for emergency services and

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public utilities, at a different (lower) economic value than the frequencies for public services, intended for consumer customers services. This review of the national frequency RF plan could target two relevant aspects:

- the first is guaranteed performance, dedicating a portion of the network to emergency management services;
- the second is economic, to encourage the widest diffusion at local level even for smaller municipalities that generally have fewer economic resources available.

From WindTre and LMT point of view on the future assessments of the business potential of these services, it is believed that the review of the aforementioned regulatory frameworks represents the essential starting point to be able to consider the focus of a concrete investment and marketing plan on services to support emergency management, through drones controlled via 5G in BVLOS flight conditions.

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CONCLUSIONS

The 5G4LIVES project has good market potential, especially in the coming years, due to the **increasing deployment of 5G networks and technological innovation**. However, there are **significant challenges to address**, including the need for robust infrastructure (nowadays the network is built to provide optimal coverage to people and devices - IoT and IIoT - on the ground), updated regulations, and cybersecurity.

About market diffusion and commercialization roadmap, the 5G network deployment scalability potential could be seen in terms of future deployment of 5G SA network to enable a dedicated Slice to ensure performances to guarantee BVLOS drones flight use cases, but it must be considered that the flight of drones is subjected to flights regulations and restrictions by Authorities, that today are limiting the use case scenarios. Adopting a specific plan of investments on the radio mobile network, is not easy at present.

Collaboration between governments, technology companies, and research institutions will be crucial to overcome these challenges and realize the full potential of the project.

The 5G4lives project testing has confirmed the effectiveness and reliability of using the 5G network to control drones in BVLOS flight conditions, for "Safe and Rescue" missions.

A series of regulatory and technological constraints are currently an obstacle to the full and pervasive use of this type of application, although there are a lot of advantages for a better and faster emergency management.

To date, the main limitations are on two fronts: Regulatory and Technological.

Regulatory:

Limitations related to flight of drones, according to the current regulation on the matter by the ENAV/ENAC Authorities in Italy, that are braking the widest diffusion and possibility of these use cases in many areas (inhabited centers, presence of infrastructures, buildings, vehicles, etc.)

The use of drones poses several challenges in public safety, privacy and cybersecurity, to name a few. While the risk related to public safety is mitigated by the drone regulations, the other issues require further analysis and in-depth analysis.

Regarding the privacy issue, at the European level some guidelines are explained by European drone regulation (EU) 2019/947, and (EU) 2019/945, which concerns technical specifications for drones.

The European Drone Regulation defines some rules that European Member States must adhere to. First, the Protection of personal data according to the well-known UE 2016/679 (GDPR): drones are systems with a camera and an internal memory, able to acquire and save personal data. For this reason, the drone system has to be considered as any other video-recording system.

For instance, drone operators must obtain the consent of the individuals concerned before collecting, recording, or transmitting personal data through the use of drones. In public spaces, people can be informed by using specific signs reporting the GDPR informative for privacy and data protection. In fact, individuals have

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the right to privacy and the protection of their personal data concerning the use of drones, and they must be informed clearly and transparently about how their data is used and processed.

However, in addition to European legislation, each European state may have its own regulations that must be respected.

It is clear that flight operations are currently limited, in particular those in BVLOS mode. At the moment BVLOS operations are only permitted over controlled ground areas ensuring that in the event of an accident, no uninvolved people are within the operational area.

This limitation arises from the risk assessment methodology proposed within SORA which is mainly qualitative. In fact, the SORA process evaluates the risk in the overall operating scenario, without analysing the operational area in detail. To give an example, SORA limits operations in urban areas because they are populated. However, although urban areas are critical, safety areas can be identified where the risk on the ground is reduced.

In order to overcome this limitation, a solution is the adoption of a high-fidelity risk assessment. For this purpose, one of the goals within the 5G4LIVES project is the development of a Methodology for planning and validating BVLOS flight, in which the core of the methodology is the adoption of a high fidelity risk assessment approach that is able to assess the ground risk of a drone operation in a quantitative approach. The high fidelity risk assessment makes use of population density data to estimate the distribution of people on the ground, and, then, estimate the number of people that can be involved in an impact with the drone after an uncontrolled crash.

The methodology will include the following functionalities:

1. Use of risk maps to quantify the risk over large areas. The risk map can be used by UAS operators to have an estimation about the distribution of the ground risk in the operational area. The risk map can be computed both offline (mission planning) and online during the mission execution.
2. Definition of a safe flight by using a risk-aware path planning approach that searches for a safe path minimizing the risk and the flight time. Also this functionality can be used offline (mission planning) and online (mission update based on the updated risk map).
3. Validation of a flight mission. Given a pre-defined route, manually planned by the UAS operator, the methodology computes the resulting risk determining if it is adequate or not.

Technological:

- as regards 5G networks, these networks were created to serve people on the ground, so the coverage is facing the ground, focusing populated/inhabited areas and where there is considerable transit (for example, roads/motorways); therefore, the current public coverage of the network does not guarantee sufficient signal and bandwidth availability above a certain height from the ground, making its use unreliable in the absence of a prior analysis of the geo-morphology of the area, the obstacles that have to be overpassed, the coverage and availability of the bandwidth/capacity, to fully enable the reliable and secure control of the drone flight.

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In a specific area, analyzed in terms of risks, obstacles, with a network coverage provided for the objectives of the project, as it was for the Turin Use Case, where a dedicated 5G coverage enable the coverage and provide the capacity so to satisfy the needs in terms of KPI (latency, peak rate end so on), the flight of drones for emergency services in all the areas with an high probability of this events, could be offered on demand, always with a case by case, project basis approach.

The Project's application outlines general KPIs generated for future performance assessment, generally associated with the Network's performance and UAV performance. These include:

1. Latency (the value is expected to be lower than 50 ms).
2. Peak data rate: the peak data rate is up to 1.5 Gbps assuming one device camped on the cell.
3. UAV KPIs.
4. Degree accuracy when tracking UAV.
5. Streaming quality.
6. Usability (app and interface).

At the same time, the Project Objectives outlined in the application serve as the basis for creating specific KPIs, which can be one of the main metrics for measuring the achievement of both Project goals and measurable values, serving as the defining parameters for Scenario design and evaluating its performance during pilots.

Wind Tre does not currently have a commercial plan for services of this kind, given the limitations mentioned above that make it impossible to make business assessments to hypothesize a launch of services on a national scale, based on a public or dedicated network.

Despite that, operators consider the possibility to offer their dedicated 5G coverage (Private Mobile Network) in a specific area, analyzed in terms of risks, obstacles. As it was for the Turin Use Case, where a dedicated 5G coverage enable the coverage and provide the capacity so to satisfy the needs in terms of KPI (latency, peak rate end so on), the flight of drones for emergency services in all the areas with an high probability of this events, could be offered on demand, always with a case by case, project basis approach.

Although Wind Tre does not have a commercial plan, but fully grasping the value of this type of 5G network applications in terms of business, it intends to invest in communication and promotion of the experimentation of the 5G4lives project, as described in the plan in paragraph 1.5 "Preliminary Marketing Strategies/Activities", in order to raise awareness among the main stakeholders like Municipalities and Industries, so that they can push their respective institutions (Government and Ministry of Industry) to intervene with aim to promote the use and diffusion of these services.

It is necessary to raise awareness among the main stakeholders responsible for managing the common good, combining bottom-up and top-down actions, through institutional functions:

- Mayors of Italian Municipalities
- Local and national Civil Protection
- Police Forces
- Industry
- Ministry of the Interior

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- Ministry of Business and Made in Italy

With regards to the 5G frequencies licensed to Telco operators, it would be desirable to review the current frequency structure, allowing operators to acquire and activate, based on demand, batches of frequencies to be dedicated to emergency management services, in order to be able to offer services with guaranteed resources and performance at a fair and favourable (or regulated) price, considering the fact that these are public utility services.

It is also suggested that a national plan be established with the collaboration between the Ministry of the Interior and Telco Operators to carry out a feasibility analysis of the use of current 5G network coverage in all areas with a high probability of risks and emergencies for people and things, with the aim of mapping the areas in which services based on the flight of drones in BVLOS are possible, those areas in which an enhancement is necessary and those in which it is necessary to provide temporary coverage, on request, in a short time.

Finally, it is suggested both at European and national level the possibility of accessing subsidized financing that allows operators to strengthen networks in high-risk areas and those in which it is necessary to provide new dedicated coverage, in order to promote the diffusion of these services as much as possible.

For additional information please refer to the document "5G4LIVES D2.1-Technology analysis, regulatory framework and use cases descriptions"

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