3GPP SA WG1 Meeting #98e S1-221039r1

Electronic Meeting, 9 – 19 May 2022 *(revision of S1-220208)*

**Source: China Mobile**

**Title: New SID on UAV Phase 3**

**Document for: Approval**

**Agenda Item: 4**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on UAV Phase 3

Acronym: FS\_UAV\_Ph3

Unique identifier:

Potential target Release: *{Rel-19}*

# 1 Impacts

{For Normative work, identify the anticipated impacts. For a Study, identify the scope of the study}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes |  | X | X | X |  |
| No |  |  |  |  |  |
| Don't know | X |  |  |  | X |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
|  | Feature |
|  | Building Block |
|  | *Work Task* |
| X | Study Item |

## 2.2 Parent Work Item

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
|  |  |  |  |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 820011 | Study on supporting Uncrewed Aerial Systems Connectivity, Identification, and Tracking | R17 study analysed and concluded on UAV connectivity, identification, and tracking. |
| 900014 | (Stage 2 of) Support of Uncrewed Aerial Systems Connectivity, Identification, and Tracking | R17 SA2 WID on the system level support of UAV authentication by UTM and UAV tracking. |
| 820026 | Study on application layer support for Uncrewed Aerial System (UAS); | R17 SA6 study on the Application level support for UAS about functional architecture and information flows. |
| 900025 | Stage 2 of  Application layer support for Uncrewed Aerial System (UAS) | R17 SA6 WID on the Application level support for UAS  |

# 3 Justification

5G mobile networks are well suited to support low-altitude drone communication and to be integrated with drone traffic management systems, in order to enhance the safety and security of drone operations. In some industrial UAV scenarios, some new functions and capabilities of 5GS can be applied to UAV flight management and application. There have already been some topics focusing on the support of UAV application in 3GPP, for example, TS 23.256: Support of Uncrewed Aerial Systems (UAS); connectivity, identification and tracking; TS 23.255: Application layer support for Uncrewed Aerial System (UAS); Functional architecture and information flows. However, there has not proposed any requirements related to additional capabilities of mobile networks for drone operations and management as listed below.

- 5G network can provide functionality or capabilities (e.g, flight mission application, flight monitoring) to support UTM functionality and to collect detailed information about UAS. The network can utilize detailed location information resource to optimize the UAV fight path scheduling based on UAV tracking and propose flight path optimization to the UTM. The information may be based on location tracking of the UAV and additional information potentially provided by the UAV, such as the parameter ’flightPathInfoReport’ in TS 36.331 that will be reported by UAV to eNB. Mobile network can utilize these location information resource to optimize the UAV fight path scheduling based on UAV tracking and provide it to the UTM. The analysis for UAV trajectory can be predicted by the 5GS via aggregating and analysing different types of data in 5GS.

- 5G network can provide wide-area, high-quality and secure connectivity that can enable cost-efficient drone operations beyond visual line-of-sight (BVLOS) range. When UAV use cellular network as the access type, the UTM/drone operator may need to acknowledge the network status, A mechanism is needed to assist UTM/drone operator to determine whether the UAV can access the network, or if already accessed, to continue the flight operation, according to the network capacity and load condition on the flight path. ACJA has defined a set of mechanisms in “**ACJA Interface for Data Exchange between MNOs and the UTM Ecosystem: NetworkCoverage Service Definition v1.00”** (https://www.gsma.com/iot/wp-content/uploads/2021/02/ACJA-NetworkCoverage-Service-Definition-v1.00.pdf) for interfacing the UAV traffic management systems with the MNO network to collect additional data from connectivity providers. However, system level requirements for provisioning of such and additional information have not been defined.

- During long flight missions, there may be the need to change the flight path of a UAV with respect to the initially planned and authorized path, or several handovers may occur, or the QoS guarantees may change during the flight, UAV service monitoring in mobile network during long flight missions with changing conditions needs further discussion, to fulfill UAV special service quality requirement.

- Traditional Detect and Avoid (DAA) mechanism are based on vehicle to vehicle communications. However, traditional aerial vehicles are not supported by a wide-area communication network like a 3GPP network. Compared with the traditional mechanism of Detect and Avoid (DAA) between UAVs that are not connected to a mobile network, DAA for networked 3GPP UAVs can also be supported by the mobile network, e.g., collision warning may be notified by the 5GS, and requirements for the support of a network-assisted or ground-based DAA can be analyzed.

- Mobile networks are being enhanced with edge solutions. An MNO network has a widespread coverage and have cell towers located over the whole network and close to where UAVs will be flying. Enhancing information collection (e.g. local UAV awareness, micro-weather awareness, etc.) by the MNO and distributing such information to UAVs by leveraging edge services would enhance the set of services that the MNO can provide to UAVs, UAV operators, and the UTM infrastructure.

Hence, 3GPP SA1 should take the responsibility and start the work to explore the further interaction between 5GS and UAV system and specify the requirements on above additional capabilities of mobile networks for drone operations and management.

# 4 Objective

The objectives of this work item are to identify additional use cases to meet industrial UAV applications in order to derive additional requirements for mobile networks to support drone operations and drone management .

Study use cases and identify potential requirements to:

* Provide additional information to the UAV operator/USS to execute pre-flight preparations and inflight operation (e.g, flight mission application, flight path recommendation, flight monitoring and control);
* Use 5G system to support enhancing the UAV flight/route management based on network capacity and QoS information along the planned route;
* Use 5G system to continue enhancing the safety and security of drone operations ( e.g. drone detection, Detect and Avoid (DAA) between networked 3GPP UAVs );
* Identify security, charging and regulatory requirements on 5GS when used for UAS operation.
* A gap analysis will be performed between potential new service requirements and identified KPIs and existing requirements and functionalities, to identify any new needs to support the identified use cases by 3GPP.

A gap analysis will be performed between potential new service requirements and KPIs and existing service requirements with regards to redundancy and reliability of command and control (C2) traffic for UAV.Note: This study would provide additional capabilities of 5GS to assist UTM, but decision/liability/legal responsibility for drones operation stays with UTM/drone operator.

Note: potential overlaps with ongoing stage-2 work (on UAS), and other S1 studies (e.g. sensing) should be considered and avoided.

# 5 Expected Output and Time scale

|  |
| --- |
| New specifications {One line per specification. Create/delete lines as needed} |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Rapporteur |
| “Internal TR” | 22.XXX | Study on on Additional capabilities of mobile networks for drone operations and managements | SA#99 (Mar 2023) | SA#100 (June 2023) |  |
|  |  |  |  |  |  |

|  |
| --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
|  |  |  |  |

# 6 Work item Rapporteur(s)

Pengtai Qin , China Mobile, qinpengtai@chinamobile.com

# 7 Work item leadership

SA1

# 8 Aspects that involve other WGs

None

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| China Mobile |
| Orange |
| Qualcomm?  |
| AT&T |
| vivo |
| ZTE |
| InterDigital |
| Futurewei |
| Verizon |
| SyncTechno Inc. |
| ETRI |
| China Telecom |
|  |