SA WG2 Meeting #S2- S2-200xxx

**Source: Futurewei**

**Title: KI # 1, 4, New Sol: network based 5G UAV identification and tracking**

**Document for: Discussion / Approval**

**Agenda Item: 8.14**

**Work Item / Release: FS\_ID\_UAS-SA2 / Rel-17**

*Abstract of the contribution: This contribution proposes a solution for issues 1, 4*

# 1 Background

The solution is to address KI #1 , #4

# 2. Proposal

It is proposed to include the following solution TR 23.754. All the text is new.

**\* \* \* \* First Change \* \* \* \***

## 6.X Solution #X: UAV remoted identification and tracking

### 6.X.1 Introduction

This solution is addressing the key issue #1, 4 to enable 3GPP system to provide aid to identify and track the UAV.

### 6.X.2 Functional Description

Per some regional regulation, such as US FAA’s listed in annex, there are two ways of UAV remote ID and tracking: one is UAV broadcasting locally, and the other is by network publishing information to internet-based database. In certain senecios, such as VBLOS, both broadcast and network publishing are required as illustrated in the following requirement from US FAA. This solution is to propose a common 3GPP architecture to support both options.



#### 6.X.2.1 Information for UAS identification and tracking

Per the regulation requirement and regulation as listed in the annex, the following information can be provided by 3GPP system for UAV identification and tracking:

* Unique UAV identifier This UAV Identifier can be assigned by USS/UTM.
* The UAV pilot/operator identification information.
* UAV controller identifier. This Identifier can be assigned by USS/UTM..
* UAV pre-configured or historic flight path.
* UAV and UAV controller location and operation time information. This can be historic information or real time information.
* UAV operation status. Status of UAV operations, such as battery level, if in auto-pilot mode.

#### 6.X.2.2 Basic Concepts

#### 6.X.2.2.1 Adoption of a UAV Flight Management Sybsystem (UFMS)

In this solution, the UAV Flight Management subsystem interfaces the 3GPP System with the USS and performs UAV Remote Identification and tracking on behalf of the USS.

NOTE 1: in some 3GPP network deployments, the UFMS may actually act as the USS, for 3GPP operators that choose to provide USS services for UAVs. In such cases, UFMS and USS are a single entity in the 3GPP MNO network.

The UFMS performs can perform the following functions:

- interfacing with external USS/UTM for registration of the UAV hardware with FAA, associating the UAV operator, UAV pilot, etc. with the UAV hardware identity

- allocates UAV identities to be used for Remote Identification, or coorelated the UAV Identifiers assigned by non-3GPP system with the corresponding 3GPP UE Identifier.

- allocates UAV security credentials to be used for Remote Identification

- creates and distributes policies to UAV (e.g. for communications, flight operations, location, etc.) based on policies received from the USS and UTM, defined by FAA, and based on local policies

- provides remote identification and tracking information to monitoring TPAEs/UTM, upon request from the TPAEs/UTM.

#### 6.X.2.2.2 Supporting Network publishing

To comply with the civil aviation authority’s requirements and recommendations on network publishing, the 3GPP network can act as USS to provide those UAV identification and tracking information’s to either a internet based database (e.g. UDM) which can be access by the authorities for ID and tracking, or can provide the UAV ID and tracking information per the query from TPAE or UTM. UFMS will coordinate the data collection for the UAV within 3GPP system, and correlated those data with the UAV identifers, then publish the information to TPAE or UTM.

There are three ways for 3GPP system to collect UAV’s remoted identification and tracking information to satisfy the requirement for the regulations:

1. Use two-way query/response communications between UFMS and UAV to allow UAV to provide the UAV remoted ID and tracking information, as well as the information for networked UAV controller.
2. UAV and network UAV controller periodically send their remoted identification information to the UFMS.
3. 3GPP system use 3GPP services, such as network cexposure function or LCS mechanism to track the UAV and provide the information to TPAE or UTM per request.

Editor Note: FFS if LCS need to be enhanced to satisfy UAV ID and tracking requirement.

In order to support method 1 and 2, there are two potential options:

1. Control plane solution: UAV and UAV controller can communicate with 3GPP system with the UAV remoted identification andtracking information via NAS to AMF, then AMF forward that information to UFMS. There will be new UTM container defined in NAS message to contain that UAV tracking information. Since many of the information are aviation level information, 3GPP doesn’t need to have visibility on that information.
2. User plane solution: UAV/network UAV controller communicate with UFMS using internet-based application level protocol via the data plane established for UAV.

Editor Note: The detail of the interaction between UAS with UNPF may be out of scope of this work.

For TPAE or UTM to query UAV remoted identification , 2 scenarios are considered in this solution:

1. TPAE or UTM has no identifier information of the UAV. TPAE and UTM will provide location information of the queried UAV to UFMS, then UFMS will interact with 3GPP LCS functions using existing or potential new LCS procedures to identify the UE which match the location information, and basing on UE profile to identify the UE which is the UAV queried by the TPAE or UTM, then send the UAV remoted identification and tracking information to TPAE or UTM.
2. TPAE or UTM has full or partial identifier information of the UAV(such as unique UAV ID). TPAE or UTM will send query with the UAV ID, and UFMS will interact with UAV or UAV controller, or other 5GC functions (such as LCS or UDM) if needed, to provide the corresponding UAV remoted identification and tracking information of that UAV.

For the interface between UFMS and TPAE or UTM for the UAV ID and tracking, a standardized API is assumed.

NOTE: this API is subjected to the regional regulation, will not be in the scope of SA2.

### 6.X.3 Procedures

6.x3.1 Remoted identification and tracking for Unknown UAV (Unknown to TPAE or UTM)



Step 1: UAV conducts registration and data connectivity procedure with 3GPP network. In this phase The 3GPP system and UFMS will have this new UAV identifier information (e.g. create an entry with mapping between the 3GPP UE ID with the UAV Identifier information)

Step 2: UAV updates UFMS with its remoted identification information (the controller may be changed during the flight) as well as the operation status information.

Step 3: UFMS updates the record of UAV remoted ID which is stored in the UDM.

Step 4: TPAE queries UFMS regarding the remoted identification information of an un-identified UAV in certain location.

Step 5: UFMS interacts with 3GPP LCS functions to obtain all of its UEs near that location.

Step 6: UFMS Identifies the UE which is UAV basing on the 3GPP UE ID and UAV ID mapping.

Step 7: UFMS queries the latest stored UAV remoted identification and tracking information from UDM using the UE ID.

Step 7: UFMS response with TPAE with the UAV remoted identification and tracking information.

6.x.3.2 Remoted identification and tracking known UAV (TPAE or UTM has some UAV identifier information)



Step 1-3 are same as previous procedure.

Step 4: TPAE sends query to UFMS for remoted ID and tracking information of the UAV with UAV ID.

Step 5: UFMS Maps the UAV Identifiers from TPAEto the 3GPP UE ID.

Step 6: UFMS obtains the UAV remoted ID information from UDM with 3GPP UE ID.

Step 7: UFMS responses with TPAE with the UAV remoted ID and tracking information.

### 6.X.4 Impacts on existing entities and interfaces

Editor's note: This clause describes impacts to existing entities and interfaces.

**\* \* \* \* End of Change \* \* \* \***