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PEER-REVIEWED ARTICLE

MODEL OF THE SYSTEM OF INFORMATION FOR THE TRAFFIC MANAGEMENT OF UNMANNED AIRCRAFT SYSTEMS

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ABSTRACT:

The traffic management of unmanned aerial vehicle (UAV) can be successful only if the data are available in order to determine the actual and future position of the vehicles. With these data the operations of UAVs can be suit to the conventional airspace users. Data generated by the different users groups and the information management operations of the traffic management systems are contribute to the increase of the safe operations of the whole air transportation system. Necessary data for the processes can be identified by the functional modeling of the UAV usage. Since modeling and analysis of particularly complex systems requires different techniques depending on the application purposes new methods have been introduced in order to facilitate the integration intentions. The elaborated model – which was created by the identification of the UAV related activities and its data needs contain the detailed data structure – provides the basis for the establishment of complex content provider systems which can manage information regarding the UAV usage jointly moreover it supports the operations of the management system. By the application of the system the availability of the necessary data in a unique and standardized format for the safe operations can be provided.

Keywords: unmanned aerial vehicles, air traffic management, drones, information system, system of information, air traffic control, planning of flight operations

Introduction

This article is the continuation of the previously published topic by the author about the traffic management challenges caused by the unmanned aerial vehicle. In the former publication the base problems have already been identified and the main conventional features of a complex control and traffic management system have been introduced. Not indicated technical background and definitions about the traffic management of unmanned aerial vehicle can be found in (Sándor, 2017).

Due to the fact that this topic is quite novel and recent, thus detailed scientific publications and research materials are not available numerously yet. The existing documentations are mostly limited to the physical implementation of the flying devices and to the control methods, not to the integrated solutions. The emergence of UAV usage requires breakthrough operational solutions that manage the safety and operational risks by the sharing of operation related data. The applicable solution, which realizes the traffic management of UAVs should cover the environmental and operational issues too.

In the everyday terminology the use of Unmanned Aircraft Systems (UAS) and Unmanned Aerial Vehicles (UAV) are often confused, or they are used as synonyms. In this study they are differentiated. The UAV is the flying object, while the UAS is a greater technical solution, which includes the UAV plus the sum of the control infrastructure (it may consist of human and technical parts).

Several scientific articles have already dealt with the functionality of the traffic management solutions of unmanned aircraft systems (UTM - Unmanned Aircraft Systems Traffic Management). Within these articles the functions – information management activities – for the integration of UAVs into the conventional airspace users have been discussed (Prevot et al., 2016; Kopardekar, 2014; UTM Global, 2017; Sándor, 2017; Jiang et al., 2016; Clothier et al., 2015; Barmpounakis et al., 2017). They discovered the essential operation functions and the limited operation environment, where the application can be performed. The results are referring to a specific implementation not to a general operation environment, which would be the basis of the widely usage. However these studies did not analyse the data and the data structures which are necessary for the fulfilment of these functions. It should be covered, because the industry is in the beginning of a significant change, where the number of Unmanned Aerial Vehicles (UAVs) is going to increase rapidly in the future (Wargo et al., 2016; FAA Forecast, 2017; Vascik and Jung, 2016). In case of the operation of a complex system the identification of the data is of paramount importance, because the structured data systems is the basis of the information management for which the full functionality can be built.

UTM is a dynamically developing area of the aviation. This development is significantly influenced by the available technology and legal environment. UTM system with full functionality and national / regional coverage does not operate in any single country, but initial solutions with platform dependent real time information sharing between users about their flight operations have been already exist. Developments will be accelerated in those areas where the legal regulation supports the industry and in these areas is expected the emergence of the UTM systems with full functionality (UTM Global, 2017; FAA Forecast, 2017; Rao et al., 2016).

UTM can be defined as a Systems of Systems (SoS) which evolves from the cooperation of the users (entities affected by the use of UAVs) and their systems. Its aims to maintain the necessary separation between the UAVs and the conventional airspace users, moreover the maintenance of the order flow of traffic in the VLL airspace segments (low altitude, near the ground; a few 10 meters above the ground level) (Prevot et al., 2016; Kopardekar, 2014; UTM Global, 2017; Gupta et al., 2013; Rios et al., 2017; Barmpounakis et al., 2017; Clothier, et al., 2015; Yanmaz et al., 2018).

In 2017, NASA conducted test flights to demonstrate the UTM capability. For the test, NASA used an own developed UAS Service Supplier (USS) and Flight Information Management System (FIMS) architecture, that collects, monitors and processes flight related data about the UAVs. Data were captured at different places at different time during several test flights. Collected data covered the following areas: UAV position and movement data, UAV status data, UAV type related data (static data), mission related flight plan data (Jung et al., 2018; Aweiss et al., 2018). These data were concerned only for the vehicle, and they do not contain any environment related data, which is relevant for the safe operations. These tests proved that a UTM architecture can collect UAV related data and it can manage it, but in the future it is important to integrate these data with other environment related data like airspace information, conventional air traffic information, terrain information, etc.

Nowadays it is a problem that the UAV related data are not available on a single platform and the available data are not comprehensive, because several data are stored or managed at different sites in different time. The aim of this article is to present the system of information model of the UTM solutions, which contains systematically and comprehensively the managed information related to the use of UAVs. The goal of the model is to ensure a complex overview approach for the UAV data management through the synthetized and predefined data structure.

The information structural model can provide a basis for the development of such complex implementations, which can manage data coming from several different sources complexly in the field of the application of UAVs and makes it possible to manage them simultaneously. Thus, the integration of UAVs into the conventional airspace users can be implemented more efficiently, which contributes to a safer, more efficient and economical air transport from the viewpoint of operational aspects. Integration can be done either with the conventional air traffic management solutions or alone for the unmanned aerial vehicles that are operating in the VLL (Very Low Level) airspace.

The development of the comprehensive integration consists of several steps and requires significant time (Abou-Senna et al., 2017; Valavanis & Vachtsevanos, 2015; Sándor & Csiszár 2015; Sándor, 2017; UTM Special, 2017; Spriesterbach et al., 2013; DoD, 2011; Madaan et al., 2018). This is supported by the system of information model from the side of data. The current goals of the integration from the viewpoint of the UTM are to maximize the operational efficiency by the availability of flight and mission related data and minimize the risks caused by the uncertain, wrong and inconsistent data.

The development steps of the integration cover the following phases from the emergence of an idea to the execution of the automatic data exchange:

1. Emergence of an integration need
2. Analysis of the operational processes, human and technical components
3. Design of the desired technical solution, with the development possibilities
4. Considering the data mapping and synchronization, as well as the operation with the quality assurance processes
5. Off-line and limited on-line test and trial operation
6. Further development based on the results of the trial operation
7. Full functionality on-line test
8. Further refinement
9. Start of the live operation

The operational steps of the data exchange between different systems may cover different implementation possibilities based on the applied technical solutions:

1. Manual data exchange between the systems
2. Semi dynamic data exchange by manual intervention with human approval
3. Time based semi dynamic data
4. Event based semi dynamic data exchange
5. Automatic data exchange

In this article only the civil use and its background of the UTM is presented. Military and state activities require other regulation and the integration of these missions into the conventional aviation system requires a different approach.

Information system of UTM solutions

During the elaboration of the model for the UTM solutions, the information system and the system of information were analysed from the aspect of the structure and operation in order to identify those entities that are used to describe a fully functional system (Sándor, 2017; Sándor & Csiszár, 2015). Previously findings about the structure (already identified technical components) and the operations (functions – information management activities – which must be provided by the system) were used for the analysis (Prevot et al., 2016; Kopardekar, 2014; UTM Global, 2017; Valavanis & Vachtsevanos, 2015; Pappot & Boer, 2015).

In order for the better understanding of the technical content of the article, it is important to determine two special terms:

- **Information system**: is part of the company (subsystem), which provides procedures for creating, recording, processing and accessing the information. It is related either to the organization or to its specific part and it assists the organization to reach its goal. Information systems are the representations of the organizations, which provide information about the status of the organization for the managing elements located at different levels in the hierarchy. For this purpose the machine system of the organization is used, which may consist of several subsystems.

- **System of information**: is a structured system of data, a set of well-structured and well-systematized information considering certain aspects. Part of the information system

The total air transportation industry as a global system is formed together by the actors involved in aviation processes and the information systems of the several industry partners, which influence base operations. The UTM systems of systems locates within this huge formation, which is the subject of the current research. Information systems provide the management of core processes, building on them, serving the industry partners.

Figure 1 illustrates the information system model of the air transportation and within it's the UTM SoS. The air transportation system consists of the vehicles of the base processes, the information system, which is influencing the operations (the UTM SoS, as the basis of current research and it is a fully functional system, which is part of the whole air transportation system) and the human components (users of the UTM SoS). The information system provides the management of the base processes built on it organically.

Figure 1. illustrates the system components according two dimensions:

- subsystems that provide functional operations from the technical side;

- basic components describing functional operations, which provide the full functional operation of the entire system.

Subsystems connect the components of the information system and ensure the collection, storage, transmission, and processing of the information that are needed for the operations, moreover the system disaggregate the functional dependencies between the components for more simple contexts by the use of processes. In addition, during the execution of certain functions, they act as interfaces between the users and the information system.

The whole system of the air transportation is extremely complex, it is formed by the several industrial partners jointly. Each partner has an own and independent machine system (and its subsystems), which provides the efficient management of the base processes on their own area of competence (e.g. ATM systems, airport systems, etc.). In order to ensure the ease of the global operations these systems are in continuous contact with each other, thus they are indicated in the figures, because the UTM SoS has contacts with the systems of other industry partners too.

Due to the high degree of standardized processes, in the field of aviation, the information management operations are well-defined and, they can be clearly assigned to the information management elements (human components) in most cases (Sándor, 2017; Sándor & Csiszár, 2015). This result that the connections are not overlapping. Subsystems perform single functional activities, thus there is no overlap between the fulfilled functions.

Based on the dependencies of the components the system of information for the traffic management of UAVs was elaborated. Scope of information management activities were revealed and analysed by the identification of the necessary data. With the integration of the data into a predefined structured, the information structural model for the UTM solutions was formed.

Information management activities are fulfilled in the information system, which is the result of a high-level functional planning. Its basis is the system of information, which contains the data and process structure necessary for the functional solutions. Information structural model is part of this, which provides the structured data storage and systematization. The realization of the information structural model is the information structural matrix, which systematically contains the managed data handled by the users connected to the execution of the functions.

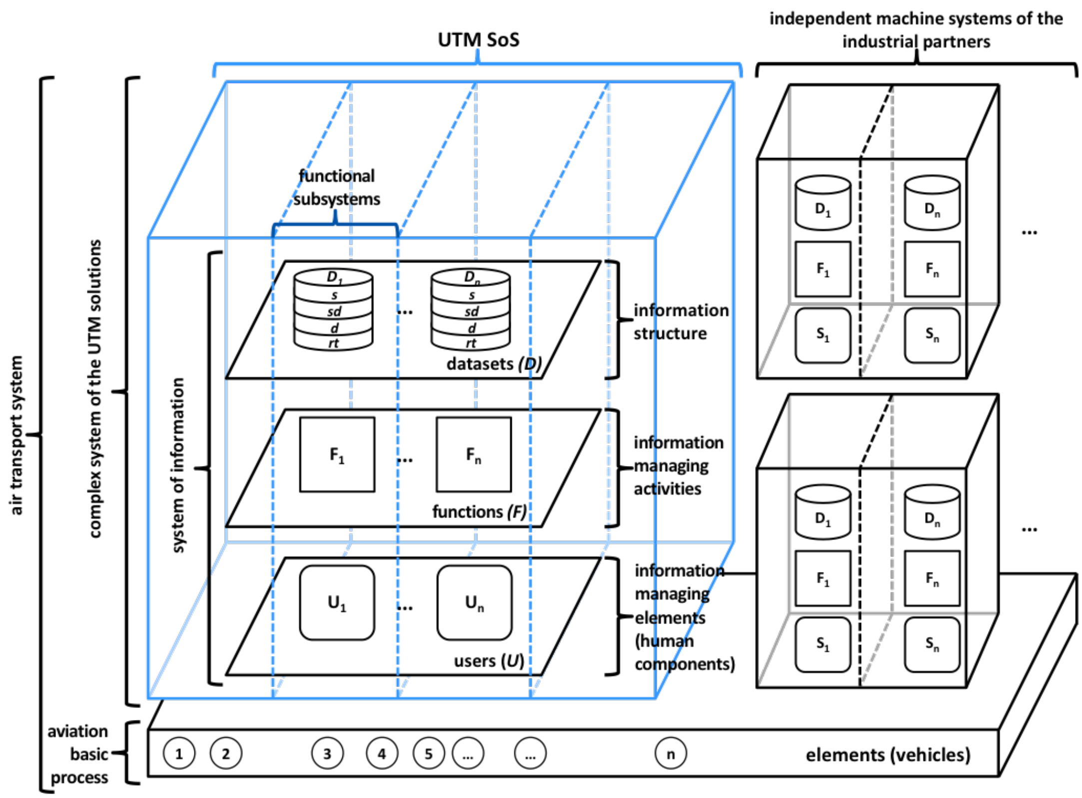

Figure 1. Model of information system for the UTM SoS [own source]

Method – Modeling the system of information

In order to elaborate the model, the operation of the air transportation system was analysed. Modeling based on the information system and system of information approach means a universal tool for the analysis of complex systems and processes (Sándor, 2017; Sándor & Csiszár, 2015). The model provides a general framework for the general components but is should be tailored to the application area and for the industry. Human users, technical parts, operational solutions, functions and restrictions have to be taken into consideration during the work. By the help of this approach human components and data can be identified which are generated during the operations in a complex system. The modeling provides possibility to group these data systematically, which is an abstract modeling. Thereby the data needs of certain information management tasks are knowledgeable, that can contribute to the developments and it can increase the efficiency of the operations. Thus, during the initial or even the further development of the systems, not only the functionality but also the data structure can be configured or fine-tuned, which is organically linked to the whole operation and is found on it.

Irrespective of the universality of the model, it is necessary to indicate the industrial specific needs and implementations inside it. This is not the case in the air traffic industry either. At the first step of the application of the model the modeling and resolution depths (the analytical depth of the components and the vertical dimension of the study) have to be clearly defined, which will be the basis for the analyses. The time scale of the activities in the different industries and the different temporal validity of the data are justify the necessity of this step.

Thus the UTM is close to the conventional air traffic management, the elaboration of the model was started with the analysis of the air traffic control and quasi parallel activities, data, systems and human components were identified through the possible effects of UAV usage. Use of UAV means the main process, because all model components were deduced from it.

Analyses were initiated at the side of the air traffic control, because the majority of the control and operative traffic organization tasks, linked with the operation of UAVs are emerged at this side. User groups, data connected to the information management activities and the machine systems were identified which are necessary for the operation of the UTM SoS.

The components of the model:

- Users
- Functions
- Datasets
- Functional subsystems

Users (U_n)
Table 1. contains the stakeholders in high-level groups, who are affected by the use of UAVs. They are the human components of the system, who handle the information management connected to the service of the UTM SoS. The list and the resolution depth might be modified according to the implementation of the applied UTM SoS. When users form a greater task based group like in the air traffic control than this user group can be called as a service.

Table 1: Human components of the UTM SoS [own source]

Notation	User group	Description
U_1	UAV operator	A person, who provides the control of an unmanned aerial vehicle at the place of use.
U_2	Pilots	Conventional aircraft commanders.
U_3	Air traffic controllers and flight information service officers	Officers of the air traffic and flight information services, who are in direct radio contact with the conventional airspace users in the controlled and non-controlled airspace.
U_4	UTM operator	Officers of the UTM SoS, who provide the operative operations.
U_5	Air traffic officer	People, who are responsible for the management of the air traffic, availability of the information materials and all other aviation related information (supporting officers of the air traffic control and aeronautical information services).
U_6	Ground officer	Supporting staff for the execution of conventional and UAV flights (generally the airport and field ground staff).
U_7	System operators	Specialist, who are operating the technical systems of the UTM solutions.
U_8	Authority officers	Staff of the Aviation Authority, who control the supervision over the area.
U_9	Emergency service officers	Staff of the state services, like police, fire, disaster and rescue services.
U_{10}	State administrators	Staff for the state registry and other state related administration actions.

Functions (F_n)

Functions are the information management activities. These were previously identified (Prevot et al., 2016; Kopardekar, 2014; UTM Global, 2017; Gupta et al., 2013; Rios et al., 2017; Barmpounakis et al., 2017; Clothier, et al., 2015). Table 2. contains the 22 functions according to the temporality of the flight / mission (definitions of the functions can be found in (Sándor, 2017)).

Functions can be realized by the help of data. These functions provide the appropriate operation of the whole UTM system, which accomplish the UTM services that are based on the UTM functions. The functions may form service on a higher level, but here the service is the traffic management of the UAVs, and all function imply an independent function which is necessary for the operation of the UTM and may be used by other industrial partners (like the surveillance, which is also used by the air traffic control).

Table 2: Functions of the UTM SoS (own source)

Temporality	Notation	Function
Pre-flight functions	F_1	Registry
	F_2	Static geofencing
	F_3	AIS provision
	F_4	User registration
	F_5	Flight / mission reporting
	F_6	Flight / mission approval
In-flight functions	F_7	Meteorological service
	F_8	Dynamic geofencing
	F_9	Surveillance
	F_{10}	Identification
	F_{11}	Two- and multi-directional communication
	F_{12}	Telemetry data management
	F_{13}	Real-time navigation support
	F_{14}	Real-time traffic information
	F_{15}	Conflict resolution
	F_{16}	Emergency management
	F_{17}	UTM-ATM interface
	F_{18}	Fleet management
	F_{19}	Record of flight / mission data
	F_{20}	Control and inspection of rules and regulations
Post flight functions	F_{21}	Analysis of flight / mission data
	F_{22}	Enforcement

Datasets (Din)

The managed data were sorted into groups by the content and the temporal validity in order the conformability and the orderliness. Table 3 illustrates the results with examples according to the dynamism and the datasets. Due to space limitation the table does not include all the data in depth. In this way, the data which are similar but map different content can be managed together.

Notation of the data:

• *n* indicates the number of the dataset (refers to the type of the content),

• *i* indicates the dynamism (temporal validity).

Type of content:

• **registry data**: data in connection with the registry, which cover the process and the equipment as well as the people as the subject of process.

• **user data**: data of the UAV operators, that are in connection with the flight missions.

• **AIS data**: data for the air navigation, most important data about the air traffic information provision (rules, regulations and other relevant information about the operative environment that is necessary for the airspace user).

• **aeronautical infrastructure data**: basic data of the air infrastructure, which describe the operative environment affected by the UAVs, moreover based on these data the missions executed by the UAVs become plannable.

• **flight / mission planning data**: similar like the conventional flight plan, it contain all detail about the mission executed by the UAVs.

• **traffic data**: position data for the effective traffic management of UAVs and conventional aircrafts that are formed by actual and predicted status information. Data are available regardless of the surveillance devices.

• **flight operations data**: mission data generated during the execution of the flight / mission. They are in connection with the given mission and they may be different according to the aim of the mission. They are mainly telemetry data, completed with position data in case of UAVs that describe the actual operative environment.

• **equipment data**: data of the off-board equipment required for UAVs (navigation, control, communication). Based on these data, it can be decided whether the operation of the required infrastructure for the execution of the mission is fulfilled or not.

• **contingency data**: Procedural, traffic, and operational data related to situations which require special handling (contingency, special priority rules, etc.).

• **surveillance data**: Data in connection with the surveillance infrastructure and the data about its operation. Data connected to surveillance and identification functions.

• **authority data**: the sum of all aviation authority surveillance and control data. Based on them the checks can be done, and their results can be recorded.

Dynamism (i):

• ***S*** **static data** (data are not changed for longer periods, their validity are longer or at least equal with an AIRAC cycle).

• ***SD*** **semi-dynamic data** (they may contain frequently changing content, thus their validity are between and AIRAC cycle and a few hours).

• ***D*** **dynamic data** (data with low temporal stability, they can change even every second, or continuously).

Table 3: Datasets of the UTM SoS (own source)

	static data	semi-dynamic data	dynamic data
registry data	D_1^s	D_1^{sd}	D_1^d
	procedures, metadata of the central database (how to store data, what data have to be stored, how to applicate and submit, etc.)	data of the registered people and equipment (type of UAV, registration ID, devices, enabling of the operators, etc.)	-
user data	D_2^s	D_2^{sd}	D_2^d
	personal base data of the UAV operators (name, identification data, address, etc.)	connection and notification data of the UAV operators, licenses, assignment data of UAVs and operators	-
AIS data	D_3^s	D_3^{sd}	D_3^d
	regulations, rules, AIP publications, communications data (frequencies, locations, etc.)	procedures, data of the pre-planned limitations (closed airspaces, etc.)	NOTAM, meteorological data, etc.
aeronautical infrastructure data	D_4^d	D_4^{sd}	D_4^d
	base data of airspaces, landing sites and sectors, previous sector capacity data, strategic airspace management and strategic airspace usage plans, obstacle data	static geofencing data, map data, planned airspace restrictions	predicted and actual sector load data, restrictions, predicted and actual sectorization data, predicted and actual airspace usage data (needs and reservations), dynamic geofencing, conflict resolution (anti-collision) data, trajectories
flight/mission planning data	D_5^d	D_5^{sd}	D_5^d
	data of the mission planning procedures (general submission procedural data, methodologies, etc.)	-	reported and approved mission data, execution data, temporal and spatial data in connection with the execution of the mission
traffic data	D_6^d	D_6^{sd}	D_6^d
	-	-	expected traffic situation data, actual UAV and conventional aircraft position data, trajectories, restrictions, conflict prediction data, conflict resolution data
flight operations data	D_7^d	D_7^{sd}	D_7^d
	-	-	performance data, sensor data, images, videos, etc. actual position data, environment data (wind, temperature, pressure, obstacles, other detected airspace users), data of the on-board devices, etc.

	static data	*semi-dynamic data*	*dynamic data*
equipment data	D^{d}_{8}	D^{sd}_{8}	D^{d}_{8}
	base data of the mission supporting equipment (type, location, etc.)	preventive maintenance data, operation parameters, limitations, expected out of service times, etc.	current operating parameters, operation monitoring data, availability data of services, predicted and current data of accessibility-limiting phenomena, etc.
contingency data	D^{d}_{9}	D^{sd}_{9}	D^{d}_{9}
	description data of contingency processes	contingency plans	contingency broadcast data, intervention data, traffic priority data, etc.
surveillance data	D^{d}_{10}	D^{sd}_{10}	D^{d}_{10}
	base data of the surveillance infrastructure	preventive maintenance data, operation parameters, limitations, expected out of service times, etc.	radar data, position data, identification data, data about the infrastructure operations, status data, etc.
authority data	D^{d}_{11}	D^{sd}_{11}	D^{d}_{11}
	procedures, authority metadata	sanctioning, violation and enforcement data	control data, observation data, evidence, etc.

Functional subsystems

The UTM SoS with full functional provides their services by the continuous cooperation of several separate subsystems (UTM Global, 2017; Sándor, 2017; Gupta et al., 2013; Rios et al., 2017; Spriesterbach et al., 2013). Subsystems support the operation of the given functions.

The applied systems can be divided into two main groups and several functional sub-units within the two main groups:

- **Technical infrastructure elements** (components, which provide the accessibility of UTM functions from the infrastructure side, without human intervention):
  - **Communication infrastructure**: base part of the UTM service which can be found between all components, without this, the service could not work. Ensures the data transfer between the different sub-units. *E.g. radio, data transfer network, etc.*
  - **Navigation infrastructure**: necessary for the UAVs in order to navigate in the airspace. *E.g. Global Navigational Satellite System, radio measurement beacons, etc.*
  - **Surveillance infrastructure**: provides the availability of position data about the UAVs, irrespective of the vehicle based localization solutions. *E.g. short wave radars, sonars, holographic radars, etc.*
  - **AIS infrastructure**: provides the necessary information for the execution of the missions. *E.g. databases, database interfaces, etc.*
  - **Meteorological infrastructure**: provides the necessary meteorological data for the execution of the missions. *E.g. sensors for the monitoring, etc.*
  - **ATM connection** platform: UTM SoS and the conventional air traffic control system share the relevant flight data mutually. Thus the necessary separation can be fulfilled between the conventional airspace users and the UAVs. *E.g. data connection solutions, procedures for the data exchange, etc.*

- **Operational support systems:** (components with human interfaces, services offered by the systems are not available when the human contribution is missing):
    - **Unmanned aerial vehicle system**: contains the UAV, the operator and the infrastructure, which is necessary for the control (flying) of the vehicle.
    - **Record systems with user and aircraft data**: state registry database.
    - **Traffic management system**: interconnects the users, thus it collects, processes and shares all mission related data with the users. By these data the safety can be increased.
    - **Authority/State Information Systems**: In order to ensure safe operations with high availability (24/7), key elements have adequate redundancy for maximum availability (e.g. UTM).

The system of information

In view of the information management activities made by the users the managed data were identified. The information structural matrix contains these data. Table 4. illustrates the structure of the matrix. Line header shows users and features. Cells of the vertical columns contain the managed information listed into datasets connected to the executed functions done by the users. The cells of the matrix contain the managed part data groups. When a given user cannot access to a function or when it is not available, the cells can be empty. The index (*i*) ranges from *1* to *n* for each component. Value of n assumes a different value for each component and it depends on the detail of the model, moreover depending on the flexibility of the model, it can be freely increased in the future, thus enlarging the detail within the given component. The breakdown illustrated in Table 1., 2. and 3. are initial implementation based on the currently identified components and the currently available technical development.

Table 4: Structure of the UTM SoS information structural matrix (own source)

User	Function	static data	semi-dynamic data	dynamic data
U_i	F_i	D_i^s	D_i^{sd}	D_i^d
U_1	F_1			
	…			
	F_n			
…	F_1			
	…			
	F_n			
U_n	F_1			
	…			
	F_n			

Result – The information structural model

The information structural model is the structure of the managed information according to the components. The model summarizes what kind of datasets is required for the operation of a certain function in a given service. The representation of the model is a matrix.

The model is a structured data structure for the identification and classification of the managed information related to UTM services. The cells of the matrix contain the managed information (Figure 2.). Machine components may be indicated in the matrix connected to the managed information, in view of the information managing actions fulfilled by the machines.

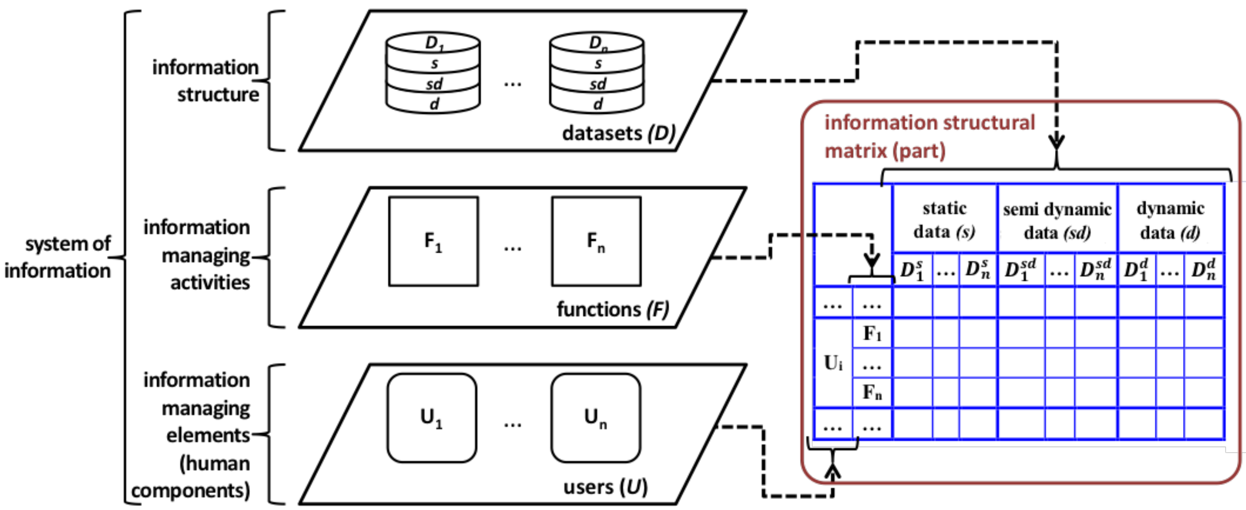

Figure 2 Information structural model of the UTM service (own source)

Discussion

In order for the safe execution of the missions made by UAVs, it is important for the UTM user community that they can access to the necessary data in an integrated way. With the integrated data management the efficiency can be increased (the uncertainty and the information acquirement time is reduced), thus the safety can be developed. The elaborated model contributes to these successes through the availability of necessary information at the right time in any place.

The integrated data management can be achieved by the elaborated model, thus providing the quick and cost effective information flow between the industrial partners in a uniform format by the use of a common platform. The integration needs time and it consists of several steps. The elaborated system of information model contributes to the first steps.

Operation of the information structural model provides comprehensive data sharing among the partners about the UAVs and their operations.

Future outlook

5th generation communication solutions will significantly contribute to the success of the industry, because the operation of this services are based on the well-organized data flow and transmission. The new services enable the remote processing of the data and the increasing spread of cloud-based solutions.

The UTM operates similar than the ATM nowadays. Due to the fact that a full functional UTM solution is not available now, the business model and the operation methods of the system are currently not known. Future research should answer these questions and address the elaboration of such measures. Two ways are considerable depending on the operational environment:

1. Independent UTM platform that operates without an ATM system / solution.
2. ATM integrated UTM platform, which operates jointly with the ATM system / solution and it amends its functions.

Future industrial developments will focus on these solutions and the integrated air traffic solutions lay down the necessary basis.

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