Bringing the UN information platform into the pragmatic perspective (central features of, and practical gains from, the proposed mechanism)

Presentation by the Delegation

of the Russian Federation

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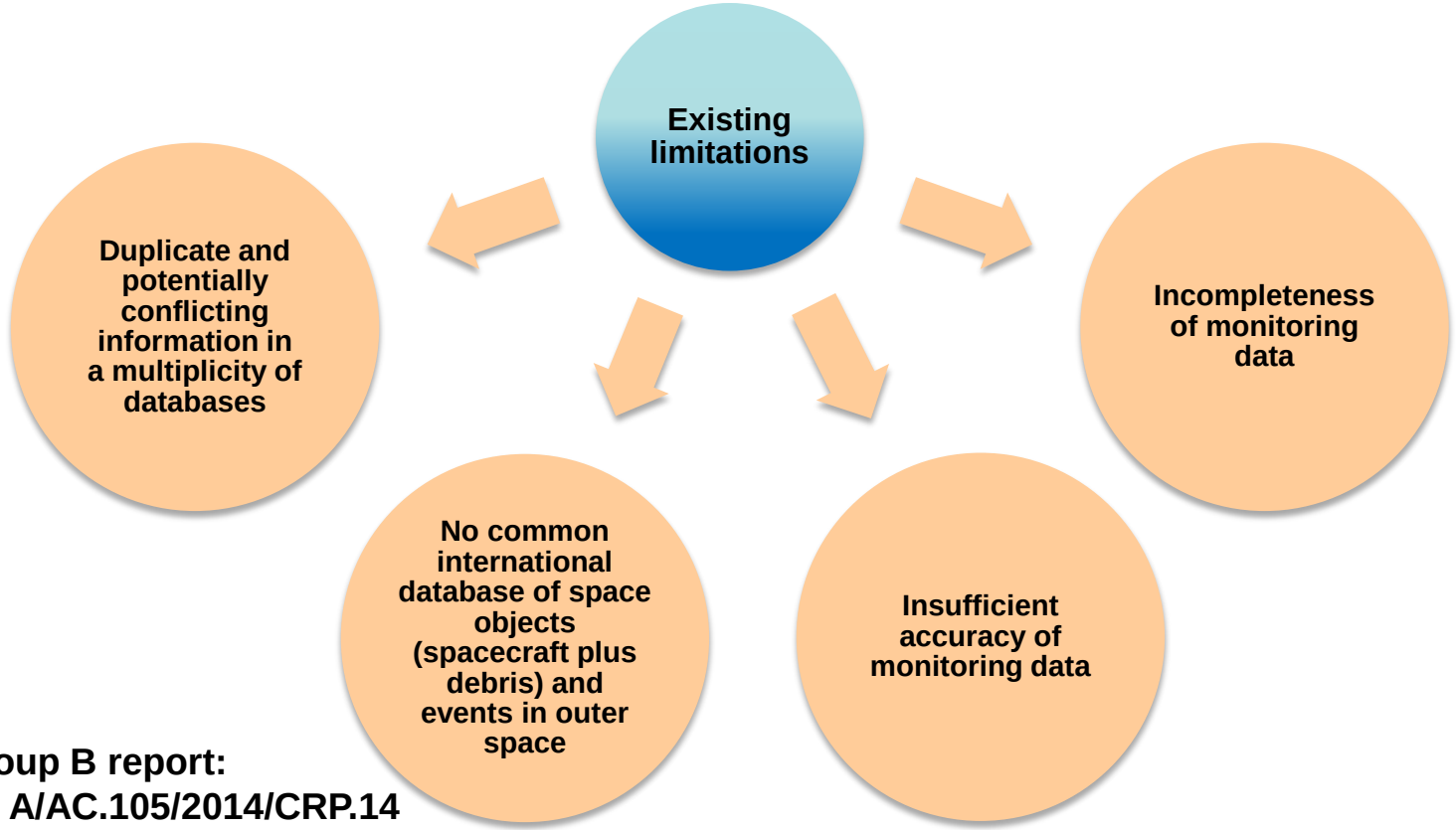
Information aspects of space operations safety

Expert Group B
(«Space Debris, Space Operations and Tools to Support Collaborative Space Situational Awareness», 2012-2014)

Noted the need to overcome limitations caused by incompleteness and insufficient quality of monitoring data



Expert Group B report: document A/AC.105/2014/CRP.14

Sharing information on objects and events in space: elaborating requirements

The relevant draft guidelines provide a general understanding of a number of important aspects related to sharing information on objects and events in outer space (document A/AC.105/L.301, guidelines 12,13)

Improve accuracy of orbital information

- combining and validating data from different sources
- improve the capabilities and geographical distribution of existing and new sensors
- passive and active on-orbit tracking aids

Use common standards of information presentation

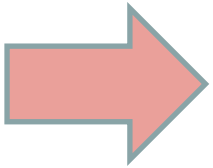
Share and disseminate information on space debris objects

Setting forth this general understanding in draft guidelines is important, however, it does not provide an ultimate solution to establishing effective interaction in sharing information on objects and events in outer space

Need for unified standards, recommendations and procedures for providing information

There is a need for standards, recommendations and unified procedures which have not been developed yet

- Rules for comparing, combining and validating orbital and other information from different sources
- Rules for making decisions on assured collision evasion operations
- Preventing situations when possible close conjunctions are missed or false alarms on conjunctions are issued
- Rules for proper use of orbital and other information



There is a need to decide on the institutional system and logical order for developing and implementing standards, recommendations and procedures

The above practical aspects should be addressed in the relevant guidelines

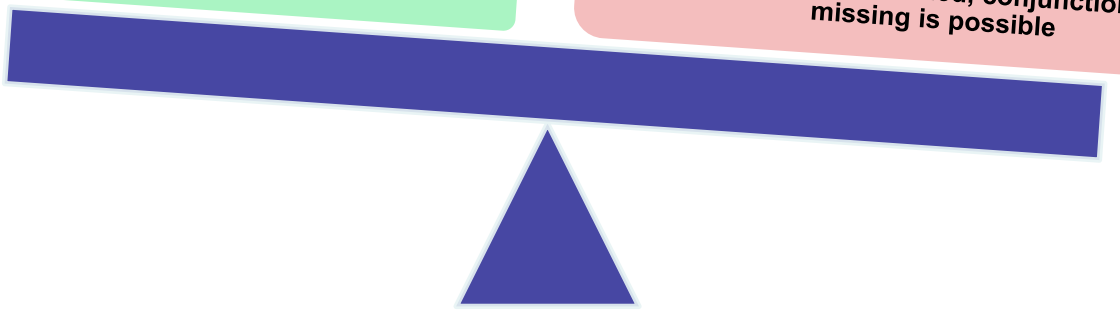
Existing practices of information interaction

Advantages

- Orbital information exchange is established between some of operators of spacecraft, some standards of information representation have been implemented
- Large volume of orbital information useful for research purposes is available for public
- Conjunction data message standard have been developed and implemented

Deficiencies

- Orbital information available for public has accuracy not sufficient in order to use such information in calculations to support real operations
- There is no unified international mechanism for cataloguing and identification of space objects that virtually guarantees duplicate and potentially conflicting information in a multiplicity of databases, assortment of data quality and completeness issues
- Monitoring information from different sources is not combined/fused. There is the lack of common criteria for evaluating data completeness, reliability and accuracy
- There is no common mechanism of comparison and verification of orbital information
- There are no common rules for evaluating conjunction hazards and decision-making on assured collision avoidance operations. As a result, there are many false alarms issued, conjunction events missing is possible



In search for a new paradigm

A rationalist view of existing practices of the outer space monitoring information exchanges allows concluding that:

Currently, information on predicted conjunctions often has low reliability, which prevents spacecraft operators (according to their own assessments) from making reasoned decisions on the need of avoidance of possible collision;

Certain problems are difficult or even impossible to solve solely through the efforts aimed at developing such practices (inevitably, the validation of information on non-cooperative objects will be complicated; increased accuracy of orbital information will not be achieved, since there is no mechanism for combining/fusing monitoring data from a multitude of sources).

Adopting a new paradigm of international information interaction should be studied thoroughly

What are the requirements for an effective and enlarged international configuration of competences in the area of outer space monitoring?

Refinement all draft guidelines on the information aspects of safety of space operations

The set of standards should be comprehensive and include standards related not only to the orbital information sharing, but also to the sharing of extended information on registration and scheduled operations (launch, active removal, destruction).

Creation of a mechanism of information interaction under the auspices of the United Nations

States would benefit from increasing quantity and quality of information on the situation in outer space obtained by means of international cooperation.

Sinergy of efforts will ultimately provide for such a level of reliability and accuracy of information that is required for adopting well-reasoned decisions on the planning and conducting of operations in outer space in a truly safe manner.

Troubleshooting in space would become much more successful if States addressed themselves to issues identified above

An international platform – the beneficial solution

“No State in the world is currently able to provide a complete and constantly updated picture of the situation in orbit on its own. Thus, there is an objective need to combine capabilities in this area…”

“The fact that there is no common database of space objects (spacecraft plus debris) virtually guarantees that there will be duplication of space objects across the several databases now maintained by different nations, differing degrees of information on objects that are registered in multiple databases, uncertainties of information on objects that are registered in multiple databases, different identifying names for the same object in multiple databases, and an assortment of other data quality and completeness issues with which actors in the space arena must reckon….”

Expert Group B report, A/AC.105/2014/CRP.14

The comparison and fusion of monitoring information received from different sources may significantly improve its quality.

The benefits of common international comprehensive, authoritative database of space objects to the long-term sustainability of human space activities would be substantial.

Technical tools of the platform

Communication channels (INTERNET)

Information providers and users of the platform

Information platform

WEB-server and server of automatic distribution of notifications

Application server

Database server (central storage of information resources of the platform)

Database administrator

Administrator of technical and program tools

Functions of the operator of the platform

System administrator (upkeep, configuration, and reliable operation of the technical and software tools of the platform).

Administrator of the platform's database.

Registration the platform users (providers and consumers).

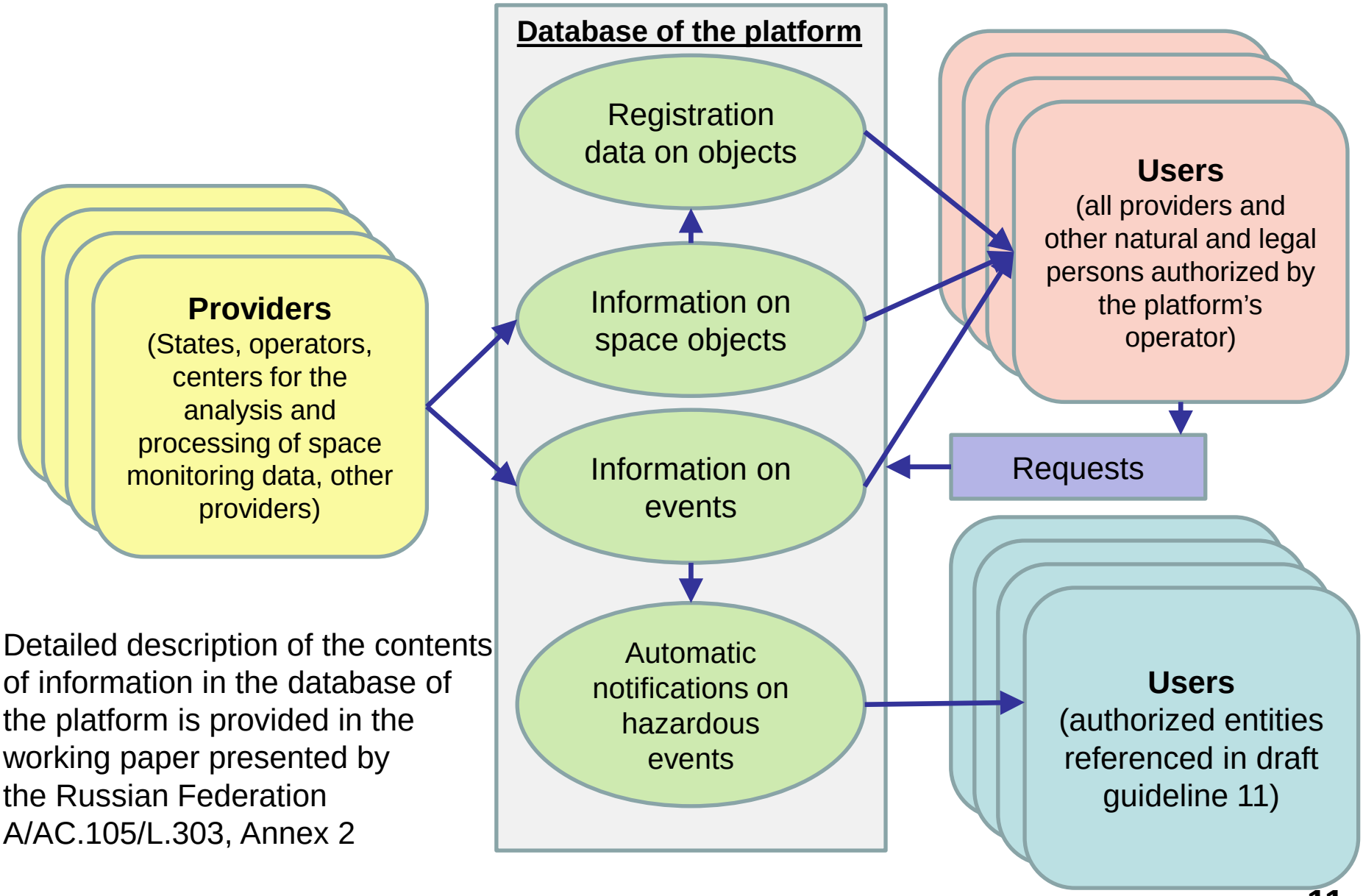
Generation of statistical reports on the filling and use of the database, reports on the changes of the situation in orbit and other reports.

Assist platform users.

Assignment of international designations to launches and space objects, matching them with the United Nations Registry.

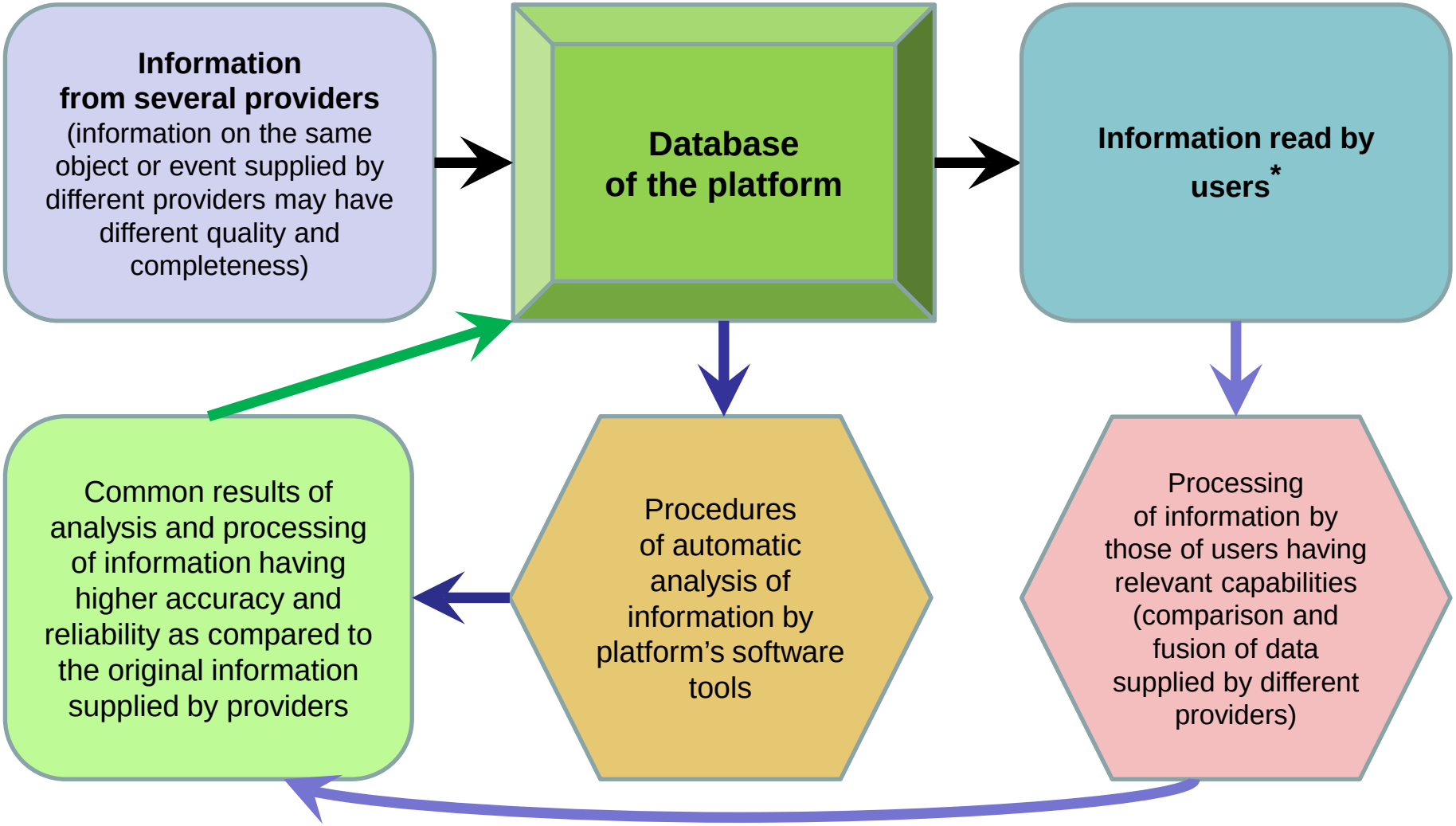
Processing of the main volume of the information from providers is intended to be performed in an automatic mode.

General scheme of information flows



Detailed description of the contents of information in the database of the platform is provided in the working paper presented by the Russian Federation A/AC.105/L.303, Annex 2

General scheme of recording, saving, reading, analysing and processing information



* *Most of users will confine themselves to information reading only. Information that due to its nature permits further processing with the aim of increasing its accuracy and reliability, could be processed by users having relevant capabilities.*

Examples of informational interaction using the platform capabilities
Case study: Upcoming launch of space objects

A

Provider of information on an upcoming launch

1. Supplies to the database initial information on: launch location and date/time interval, parameters of nominal launch trajectory, basic data space objects to be launched, type of a launch vehicle

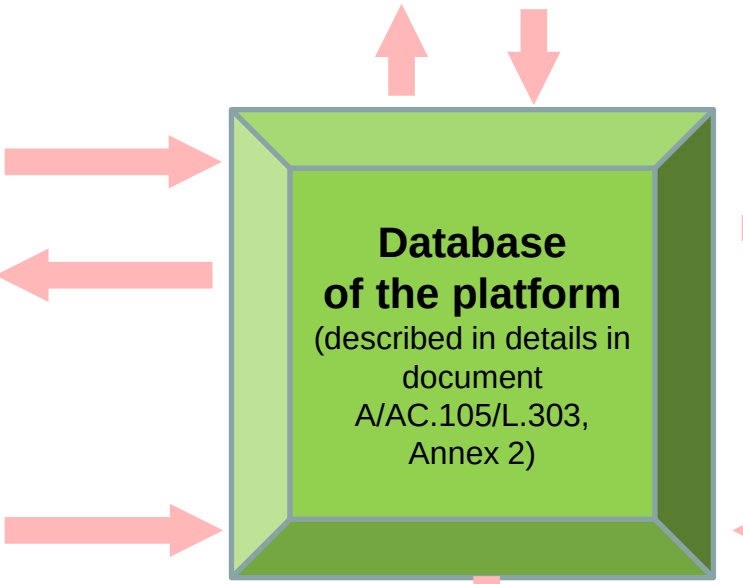
2. Receives required information form the database and adjusts launch time interval in order to avoid collision with other on-orbit objects during the launch phase

3. Supplies to the database adjusted information on: launch time intervals, parameters of areas of air space and maritime areas that pose risk to aeronautics and navigation during the operation of launching a launch vehicle

B

Users capable of performing assessment of possible close conjunctions

1. Receive information placed by providers into the database and use it simultaneously with space objects trajectory data they have for screening possible close conjunctions at the launch phase
2. If possible close conjunctions at the launch phase found, supply appropriate notifications for recording to the database



C

Operator of the platform

1. Reads information from the database

2. Assigns a unique identification number to an upcoming launch (not to be confused with international designation!) and saves it in the database

D

Automatic procedure performed by the platform (under supervision of the platform's operator)

1. Reads information on the upcoming launch of space objects from the database
2. Disseminate notifications on the upcoming launch

Examples of informational interaction using the platform capabilities
Case study: Accomplished launch of space objects

A

Provider of information on accomplished launch

Supplies to the database actual information on:
lift-off date and time; launch location; launch vehicle type; composition and names of space objects placed on orbit in the course of the launch (number of spacecraft, stages of launch vehicle, accompanying operating fragments); reference to State which exercise jurisdiction and control over each space object

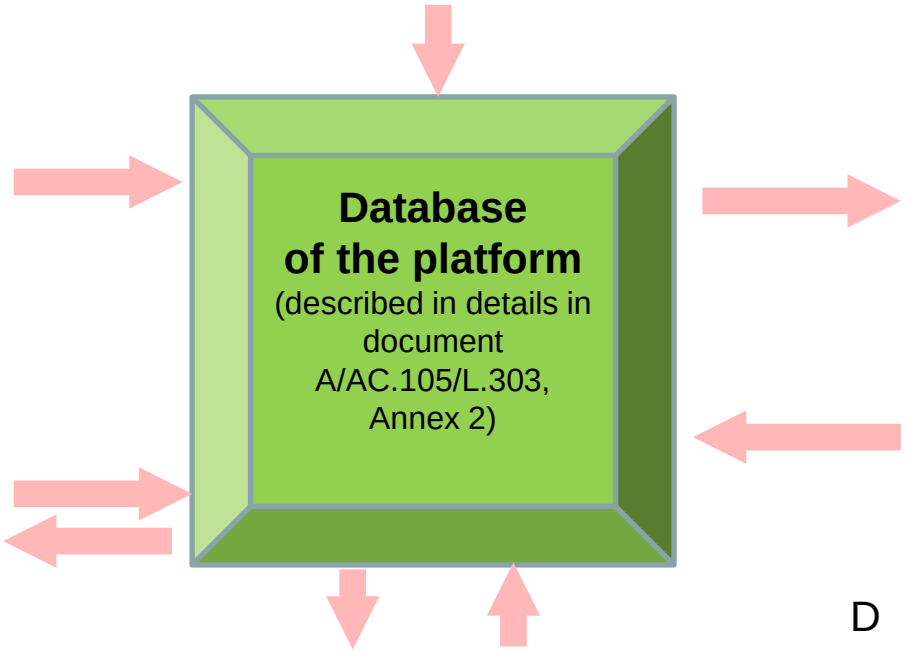
B

Providers of information on space objects placed on orbit

1. Supply to the database: confirmation of ability to control each launched space object (of the establishment of contact between such object and the ground service) or of the establishment of the fact of inability to maintain control; parameters of trajectory of motion of space objects based on telemetry data
2. Receive from the database: Information on trajectory of motion of objects associated with the launch which had been detected by monitoring systems; international designations of objects

Providers having capabilities to monitor outer space on a routine basis

Supply to the database information on trajectory of motion of newly detected space objects (in OEM format, CCSDS 502.0 Orbit Data Messages) and their characteristic dimensions



C

D

Users capable of performing analysis of space objects motion and assessing characteristics of events in outer space

1. Receive information from the database
2. Perform analysis aimed at assessing possibility to establish the connection between newly discovered space objects and accomplished launch
3. Provide results of analysis to the database

E

Operator of the platform

1. Assigns a unique identification number to the new space objects (not to be confused with international designation!) and saves it in the database
2. In case of confirmation the fact the newly detected objects have been positively associated with the launch – assigns international designations to the launch
3. Upon receiving additional information on newly launched objects and establishing the connection between space objects discovered by monitoring systems and objects of the accomplished launch assigns international designation to each of objects

Examples of informational interaction using the platform capabilities
Case study: Predicted conjunction of a functioning spacecraft with other space objects

A

Provider of information on functioning spacecraft

1. Supplies to the database information on parameters of the current (updated by telemetry data) and predicted trajectory of motion of the spacecraft (in OEM format, CCSDS 502.0 Orbit Data Messages) considering planned operations on changes of trajectory of motion; information on dimensions of the spacecraft

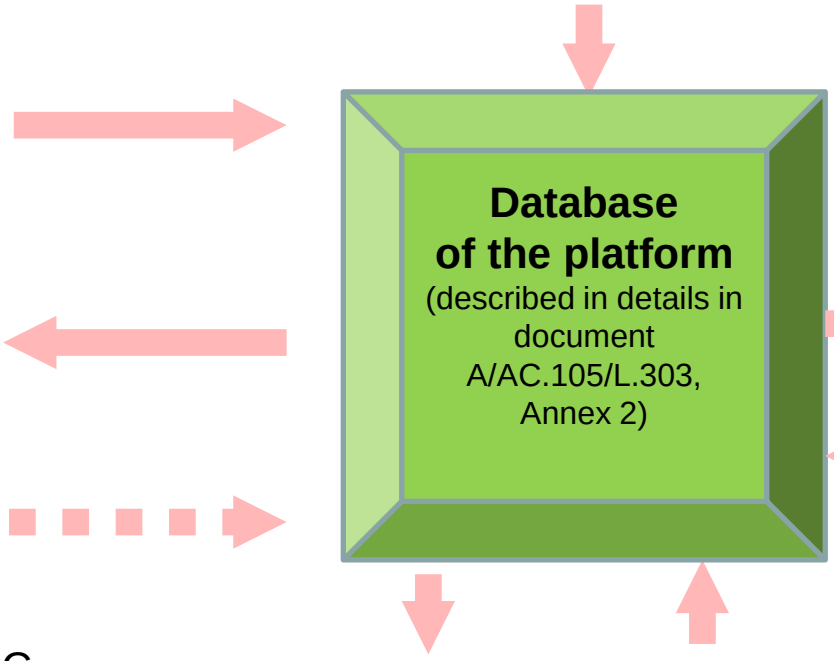
2. Receives from the database information on predicted conjunctions

3. Performs detailed assessment of the conjunction hazard. Makes decision on the need or lack of expediency of adjustment of trajectory of motion of the spacecraft. In case of adoption a decision on the need of adjustment of trajectory of motion, works out possible options regarding the pre-planned trajectory of motion (in OEM format, CCSDS 502.0 Orbit Data Messages) and supplies this information to the database

B

Providers having capabilities to monitor outer space on a routine basis

Supply to the database information on trajectory of motion of space objects (in OEM format, CCSDS 502.0 Orbit Data Messages) and their characteristic dimensions



D

Automatic procedure performed by the platform (under supervision of the platform's operator)

1. Reads information on trajectories of motion of space objects from the database
2. Calculates conjunctions and saves results to the database
3. Disseminate notifications on close conjunctions

C

Users capable of performing assessment of possible close conjunctions

1. Receive information on space objects trajectories of motion from the database.
2. Perform screening for potential conjunctions for a functioning space objects having information on predicted trajectory of its motion supplied by providers to the database
3. Supply to the database information (in accordance with CCSDS 508.0 standard "Conjunction Data Message") on expected conjunctions of the functioning space object with other space objects

Examples of informational interaction using the platform capabilities
Case study: In-orbit break-up of a space object

A

Provider of information on space objects with respect to which it exercises jurisdiction and control

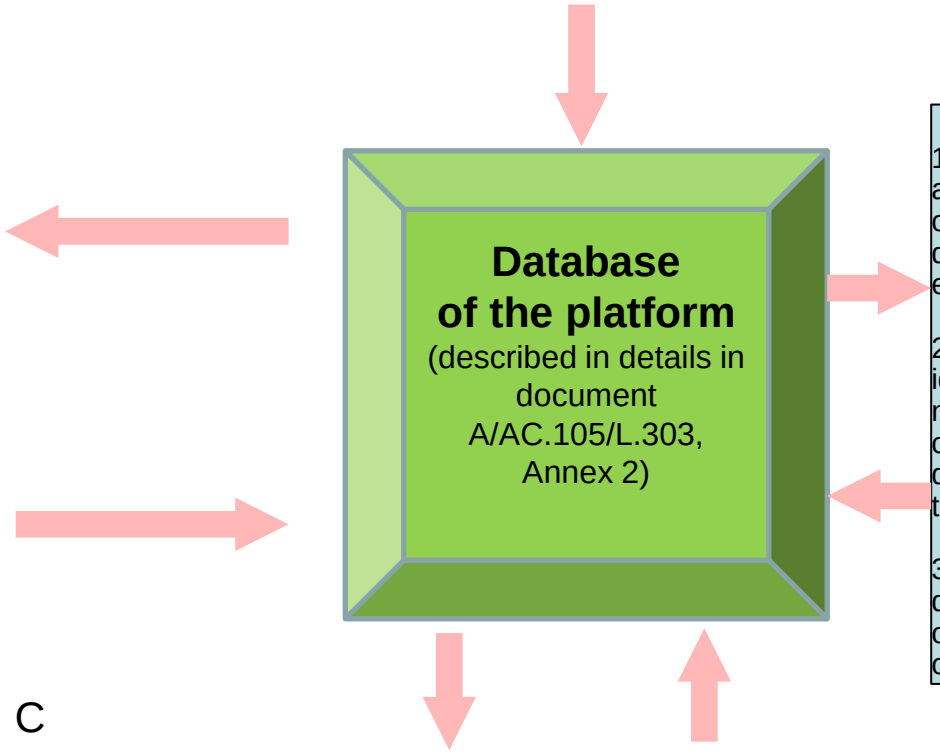
1. Receives from the database information on new objects supposedly having relationship to a space object with respect to which the provider exercises jurisdiction and control

2. Performs detailed assessment of the received information and compares this information with own data (for example, telemetry data). Provides to the database information that confirms the fact that control over space object has either been lost or retained, as well as information on the change of status of the space object, information on possible reason for a break-up and basic characteristics of the space object at the time of the break-up (mass, dimensions, attitude, parameters of orbit).

B

Providers having capabilities to monitor outer space on a routine basis

Supply to the database information on trajectory of motion of newly detected space objects (in OEM format, CCSDS 502.0 Orbit Data Messages) and their characteristic dimensions



D

Operator of the platform

1. Reads from the database available information on space objects associated with the detected in-orbit break-up event.

2. Assigns a unique identification number to the new space objects (not to be confused with international designation!) and saves it in the database.

3. Assigns international designation to new space objects associated with the in-orbit break-up event.

C

Users capable of performing analysis of space objects motion and assessing characteristics of events in outer space

1. Receive information from the database.
2. Perform analysis aimed at assessing possibility to establish the connection between newly discovered space objects and presumed in-orbit break-up event.
3. Supply to the database information on the connection between objects and this break-up event and assessments of characteristics of this event.

Examples of informational interaction using the platform capabilities
Case study: Predicted or actual deorbiting of a space object from near-Earth orbit

A

Provider of information on predicted or actual deorbiting of a space object

1. Supplies to the database information on: International designation of an object which is planned to be deorbited; parameters of predicted orbit from which the object will be de-orbited; time intervals for de-orbiting; parameters of areas of possible impact of fragments of the space object; mass and dimensions of spacecraft design elements which may, with high probability, reach the surface of the Earth; possible chemical or radiation hazard posed by spacecraft design elements.

2. Supplies to the database updated information:
actual date and time of de-orbiting, estimations of time of re-entry, coordinates of the point of entry into dense layers of atmosphere, boundaries of area of possible fall of fragments.

3. Receives from the database information on:
discovered fragments, eyewitness accounts and instrumental confirmations as regards the passing of the object through the atmosphere.

B

Authorized providers from States whose territories could be affected by possible fall of fragments

1. Receive from the database information on planned operation of controlled de-orbiting and updated information on performed de-orbiting operation
2. Provide to the database information on coordinates of impact areas, mass of discovered fragments, eyewitness accounts and instrumental confirmations as regards the passing of the object through the atmosphere

Database of the platform
(described in details in document A/AC.105/L.303, Annex 2)

C

Automatic procedure performed by the platform (under supervision of the platform's operator)
1. Reads from the database information on planned operation of controlled de-orbiting.
2. Disseminate notifications on planned operation of controlled de-orbiting.

Benefits that could be derived from the platform

For those who use monitoring information (spacecraft operators and organizations conducting space launches)

- acquiring ability to obtain objective monitoring information needed to ensure the safety of spaceflight and space operations with greater efficiency, accuracy and reliability
- acquiring possibility to establish global coordination in carrying out operations in space
- acquiring ability to improve completeness, validity and accuracy of information on objects and events in space due to the comparison and fusion of information from different providers

For those who provide monitoring information (organizations performing outer space monitoring and analysis of monitoring information)

- acquiring ability to prepare in advance a plan for optimal observations of space objects associated with upcoming launches to improve efficiency of the information provision
- acquiring ability to use more efficiently limited technical resources available for monitoring purposes through the use of platform-provided information on operations in space in process of the interpretation of data
- increasing efficiency, accuracy and reliability of information on objects and events in outer space generated with the use of platform-provided information

Establishment of the platform would serve the purpose of strengthening the long-term sustainability of, and increasing the level of transparency and predictability in, outer space activities

Thank you for your attention!

Extra slides with comments to presentation

Information aspects of space operations safety

In 2012–2014, Expert Group B of the Working Group on the Long-term Sustainability of Outer Space Activities focused, in particular, on considering information aspects of space operations safety.

In its work, Expert Group B endeavored to adopt and be guided by a reality-principle as regards the field under consideration.

Group B stated the need to overcome limitations caused by incompleteness and insufficient quality of monitoring data, considering that such limitations affect and will affect any information sharing practices.

The lack of a common international database on space objects and events was pointed out as a factor that impedes interactions between States on space operations safety.

Sharing information on objects and events in space: elaborating requirements

The relevant draft guidelines provide a general understanding of a number of important aspects related to sharing information on objects and events in outer space, including the need:

- To improve accuracy orbital information, in particular by combining and validating data from different sources;
- To use common standards of information presentation;
- To share and disseminate information on space debris objects.

Setting forth this general understanding in draft guidelines is ***important, however, it does not provide an ultimate solution*** to establishing effective interaction in sharing information on objects and events in outer space.

Draft guidelines 12, 13

(document A/AC.105/L.301)

Need for unified standards, recommendations and procedures for providing information

There is a need for a clear guidance that would determine the exact way, institutional system and logical order for developing and implementing standards, recommendations and unified procedures related to:

- Comparing, combining and validating orbital and other information from different sources;
- Rules for making decisions on assured collision evasion operations;
- Preventing situations when possible close conjunctions are missed or false alarms on conjunctions are issued;
- Checking completeness, reliability and accuracy of orbital and other information;
- Rules for proper use of orbital and other information.

Critical and unbiased survey of the tentatively agreed draft guidelines suggests that there is also a need to address the above practical aspects in these guidelines.

Existing practices of information interaction

Ensuring space operations safety using current practices of interaction in information provision (through such organizations as the Space Data Association and the Joint Space Operations Center) is rather complicated, since:

- Orbital information available for public has accuracy not sufficient in order to use such information in calculations to support real operations;
- Space objects monitoring data from different sources is not combined/ fused;
- There are no mechanisms for comparing and validating orbital information (the situation is even exacerbated by the lack of common criteria for evaluating data completeness, reliability and accuracy);
- Common rules for evaluating conjunction hazards and decision-making on assured collision evasion operations have not been developed yet;
- There are no unified international mechanisms for cataloguing of space objects (similar to those used by the Minor Planet Center) that would enable interrelations between data from different sources on the same space object.

What are the requirements for an effective and enlarged international configuration of competences in the area of outer space monitoring? (1)

First of all,

It is necessary to refine all draft guidelines on the information aspects of safety of space operations. The set of standards should be comprehensive and include standards related not only to the orbital information sharing, but also to the sharing of extended information on registration and scheduled operations (launch, active removal and destruction). Pursuit of isolated issues in the sphere of information exchanges will not make the whole regulatory framework authentically safety-oriented. The unwillingness of certain States to subscribe to a number of premises to ensure safety of space operations demonstrates, *inter alia*, lack of plans to increase openness in sharing information on its own space operations, for instance, with regard to the launch phase, to the separation of subsatellites, despite of the fact that all these elements of information support for ensuring safety of space operations should be an integral part of a fair policy on information sharing.

What are the requirements for an effective and enlarged international configuration of competences in the area of outer space monitoring? (2)

Second,

The very opportunity of interaction of competences in the area of outer space monitoring within the enlarged international pattern is uncertain: some States do not agree to discuss the ***creation of a mechanism of information interaction under the auspices of the United Nations***. They have the right not to agree. However, logic suggests that all States guided by, *inter alia*, their own interests, should have reacted to this initiative in a prudent way, if only because they would ***benefit from increased volume and quality of information on the situation in outer space obtained by means of international cooperation***. ***Sinergy of efforts*** will ultimately provide for such a level of reliability and accuracy of information that is required for adopting well-reasoned decisions on the planning and conducting of operations in outer space in a truly safe manner.

Troubleshooting in space would become much more successful if States addressed themselves to issues identified above.

Interaction within the platform

The concept of the platform assumes the following pattern of interaction.

Motivated providers (States, operators, centers for monitoring data analysis and processing, and other providers) supply information on objects and events in space to the unified database available for all users registered by the platform operator (United Nations).

Motivated users who are capable of processing the information uploaded to the platform database, will be able to read it and then return the results of processing to the database in case those results are more accurate and reliable thanks to the data comparison and fusion.

Expansion of the volume and reliability of the space situational information having broad application could be achieved through automated centralized data sharing mechanism which, in terms of the support it needs, would not be burdensome either for information providers or platform operators.

Apart from these basic functions, the platform could send automatic notifications in contingency situations to the entities authorized by States and international organizations, as provided in the current version of draft guideline 11.