

## Synthesis of the Space Debris Symposium, after analysis of data from 2011 to 2016.

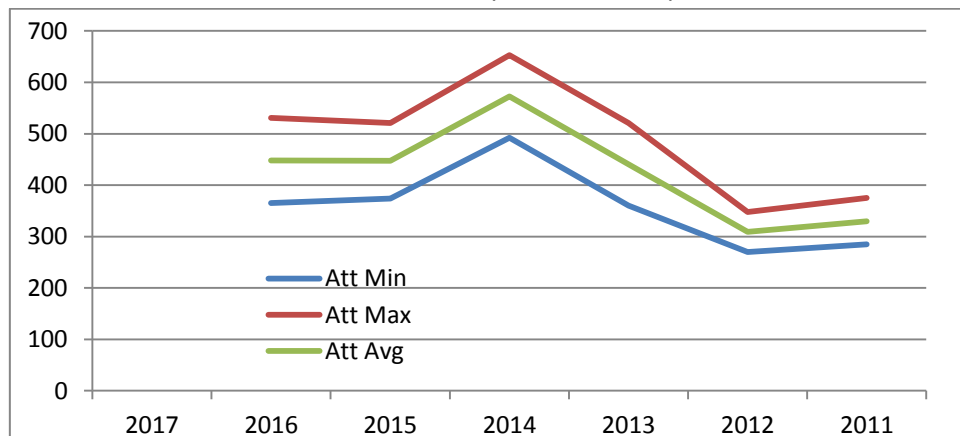
Note: Some figures in the following pages are not always completely coherent. This is normal, considering the Posters (not taken into account in this first edition), as well as manuscripts proposed to other symposia during the March meeting, or on the contrary welcome in A6. The trends presented here are nevertheless quite robust.

### General overview:

- Progressive increase in number of sessions from 6 to 9 (3 in 2000), sound and stable. The YPVF session added as a 10<sup>th</sup> one in Jerusalem should not be included, as it was not organized by the Space Debris Committee and turned out to be very bad, not to be retested.

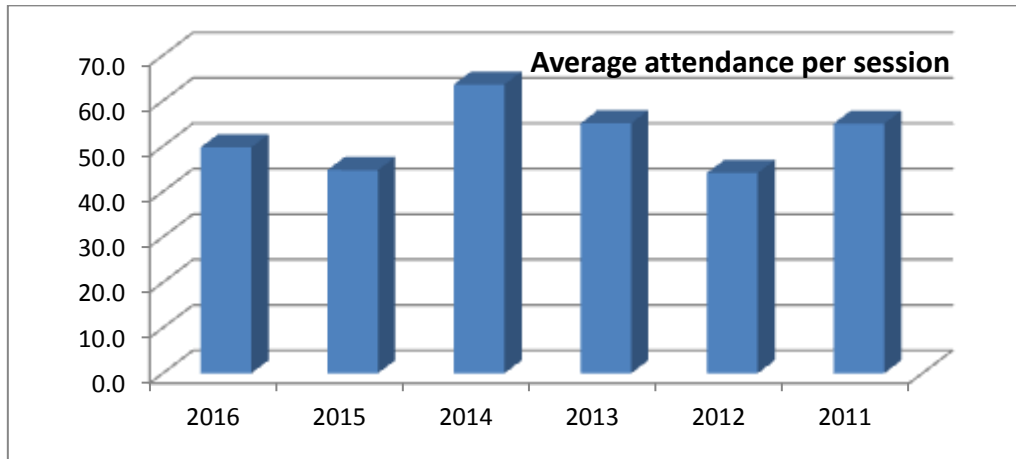
IAC	Year	Location	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6	Session 7	Session 8	Session 9	Session 10
51st	2000	Rio de Janeiro										
52nd	2001	Toulouse										
53rd	2002	Houston										
54th	2003	Bremen										
55th	2004	Vancouver										
56th	2005	Fukuoka										
57th	2006	Valencia										
58th	2007	Hyderabad										
59th	2008	Glasgow										
60th	2009	Daejeon										
61st	2010	Praha										
62nd	2011	Capetown										
63rd	2012	Naples						Joint				
64th	2013	Beijing										
65th	2014	Toronto								Joint		
66th	2015	Jerusalem								Joint		Joint
67th	2016	Guadalajara								Joint		
68th	2017	Adelaide								Joint		Joint

- The attendance to A6 sessions is globally very good. The following diagram presents the sum of the average number of participants to all the A6 sessions, over the years. The average is 424, with nearly 500 these 3 last years. Peak was 650 in Toronto. Guadalajara was clearly disappointing, seeing the total number of congressists present this year; it is important that IAF secretariat understands where these 5217 persons have spent their week...

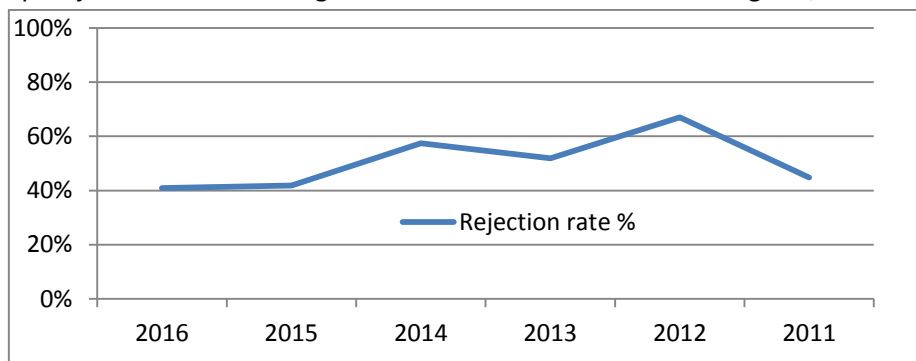


- The attendance per session is also important, and is different from the previous curve as the number of sessions has increased over the years. Double average (over sessions and over years) attendance is 52 participants per session (YPVF 2015 excluded); stable values, with only little variations from low 45 (Naples, Jerusalem) to high 64 (Toronto). As we've had a

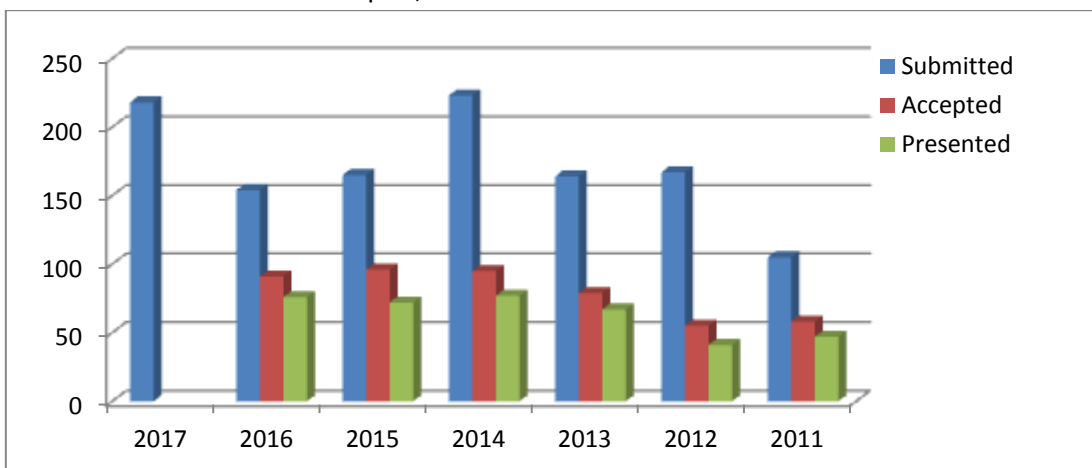
constant number of sessions these last 3 years, Guadalajara is clearly disappointing, probably due to the competition with the GNFs.



- Average 163 submissions (171 when including Adelaide), with average 79 accepted, means 51% rejection. Toronto was high, with 57%, and strangely Naples was even higher with 67% rejection. Guadalajara was a bit disappointing with only 41%. This average value of one manuscript rejected out of two is good and normal for this kind of congress,



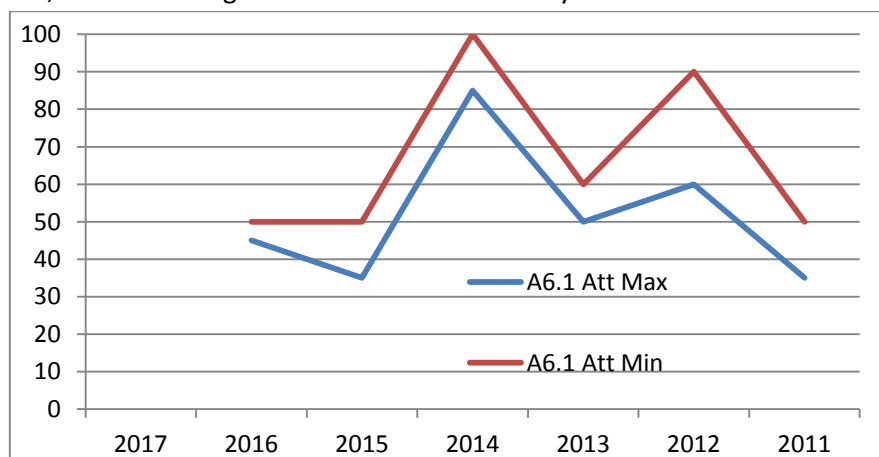
- In average 80% of the accepted papers are presented, which is improvable, but impacted by the high rate of withdrawn during IAC 2015 in Jerusalem (25% withdrawn and no shows); similar situation in IAC 2012 Naples,



- The number of No-Shows is low, with an average of 4% and a highest in 2012 in Naples with 12%; there is probably an uncompressible value corresponding to travel problems (Chinese visas) or personal matters,
- The ratio of uploaded manuscripts versus the number of accepted papers is good, at 83% in average, but is hard to interpret: low in Jerusalem 2015 (76%), meaning early cancellations of participants, vs high in Naples 2012 (100%), meaning very late cancellations when the papers were already written,
- The ratio of uploaded manuscripts versus the effective number of presentations is also good, with 104% (some did upload their manuscript but were not there to present it, for instance Chinese colleagues blocked at last minute by visa problems). This 100% value is normal, and corresponds to a good application of the “no paper no podium” rule which is relatively well followed in our symposium, despite a few exceptions,
- The number and ratio of uploaded presentations was not analyzed, as it has no signification. It is hard to imagine someone presenting a paper without using a presentation, and it is often required to suppress the presentation from the system as soon as the talk has ended,

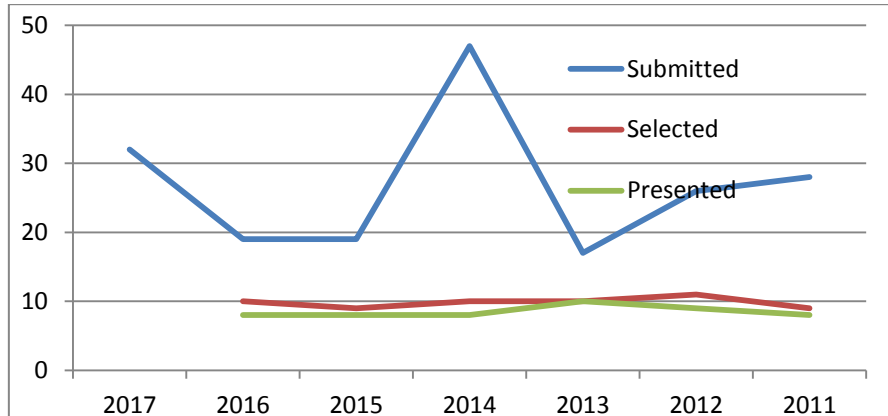
Analysis per session:

- Note that concerning the submission rate the information is not always directly available; when digging in the past presentations held during the March meetings, the following data can be found:
- A6.1 “Measurements” is a very specialized session which has always met a good participation, with an average of 59 attendees over the years.

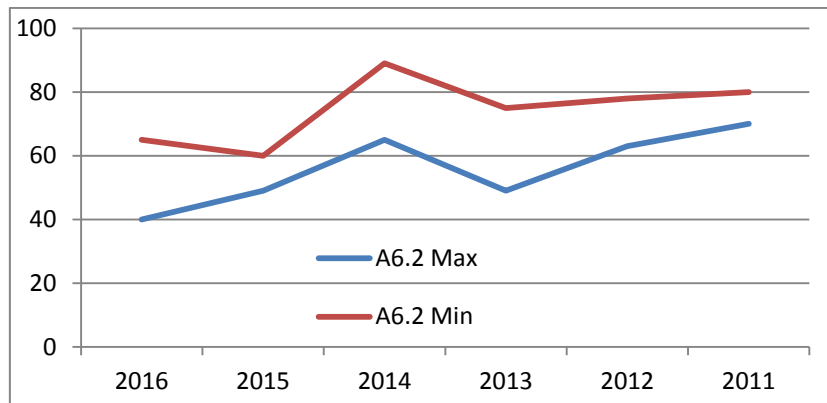


It has one of the highest rejection rate, 62%, an average of 10 papers selected and 86% of them being presented. In Toronto with a rejection rate of 79%, despite numerous very good proposals, it was decided to initiate a new session A6.7 “Operations in Space Debris Environment, Situational Awareness”, A6.1 remaining the “scientific one, A6.7 being more on the operational side; this explains the relatively lower scores witnessed in 2015 and 2016. In addition, in 2016, this session suffered from the competition of the AMOS conference held the previous week, gathering the same experts.

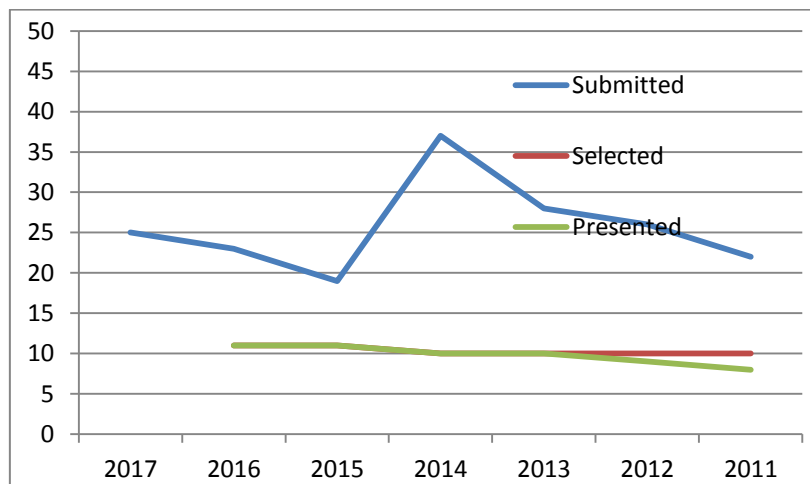
Despite this, A6.1 is definitely one of the “solid” sessions of A6.



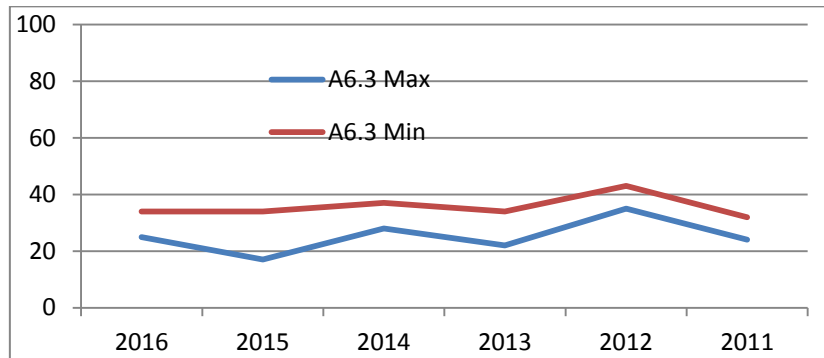
- A6.2 “Modeling and Risk Analysis” is also a “classical” session, always very well attended, with an average of 65 attendees (upper figure). Clearly a bit disappointing in Guadalajara, being in direct competition with the “industry” GNF, leading to a score even lower than Jerusalem; it is completely illogical and abnormal to see that this session, for Min values, has gone to a historical low.



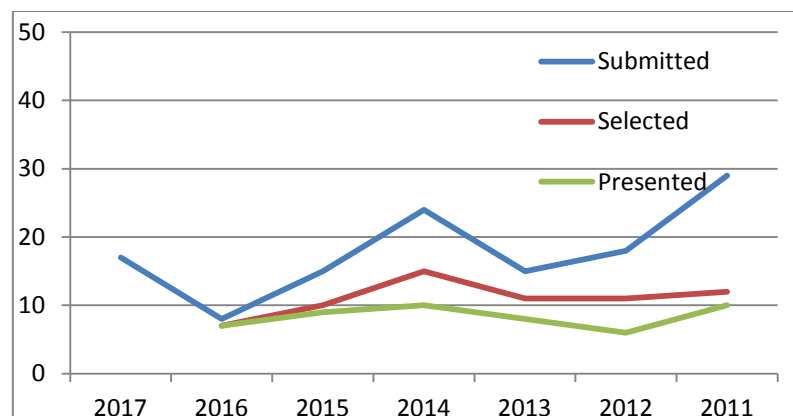
As for A6.1, following the great success of Toronto where 73% of the submissions had to be rejected, it was decided to initiate a new sessions A6.9 “Modelling and Orbit Determination”, here also A6.9 being the operational one and A6.2 remaining the more scientific one. With a record of 95% papers presented compared to the selected (100% these last 3 years!), it is a very good and solid session.



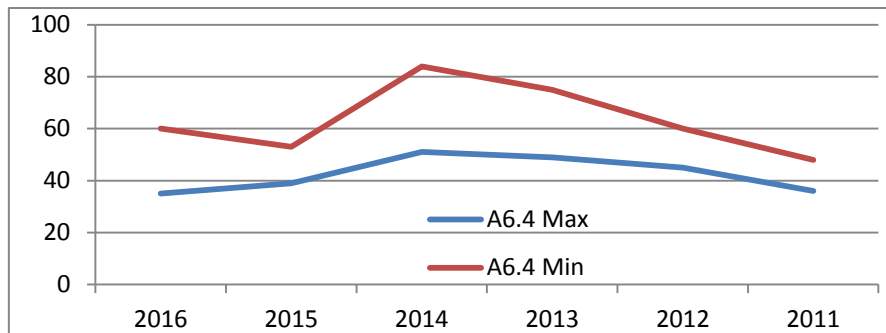
- A6.3 “Hypervelocity Impacts and Protection” is a highly specialized session dealing with ballistic limit equations and tests, unique to the domain. It is important to have such a high level technical session even if it means that mostly experts of the topic will attend. It leads to a slightly lower participation compared to other sessions, 30 in average, due to this high degree of technicity. Furthermore, since a couple of years, the Steering Group Meeting of the IADC takes place at the same time, on Wednesday morning, preventing a few “classical” potential participants from attending.



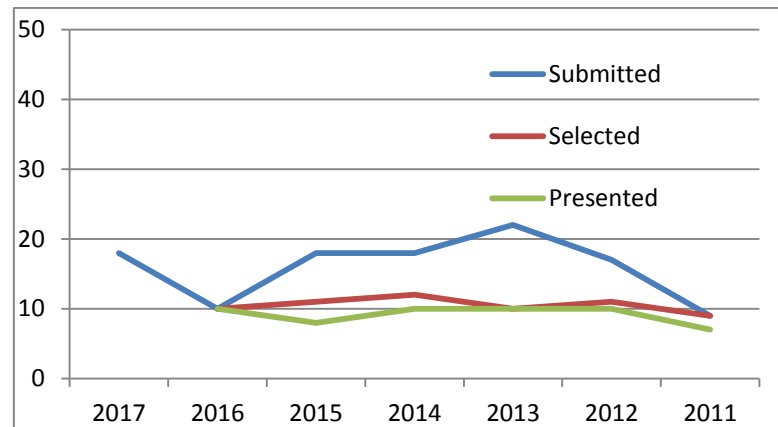
The number of papers submitted has been steadily decreasing these last years, with the exception of Toronto, and Guadalajara was really bad, with only 8 papers submitted and 7 selected. This is abnormal and shall lead to actions during the next Space Debris Committee meeting. If this tendency was to continue in the future, keeping or not this session should be questioned.



- A6.4 “Mitigation and Standards” is a historical “classical” session. It was so successful over the years that it led to a general redefinition of the other sessions from 2014 on, with numerous papers which were originally in A6.4 dispatched in A6.5, A6.6 and A6.8; this explains partially the relatively low number of submissions. In addition, Mitigation has been a very vivid topic these last 20 years, but now comes a bit to an end: the standards have evolved over the years, and are now approved (even if not very well applied...). Their efficiency is dealt with in A6.2, and the side effects as “legal”, “insurance”, “political” topics are addressed in A6.8. Last, it is a session where most of the information is known from members of the space debris community (IADC, ISO, Darmstadt conference...) and there is not so much “new” to be presented every year. It nevertheless gathers more than 50 attendees every year, which is excellent! (With, once again, Guadalajara being a bit disappointing).

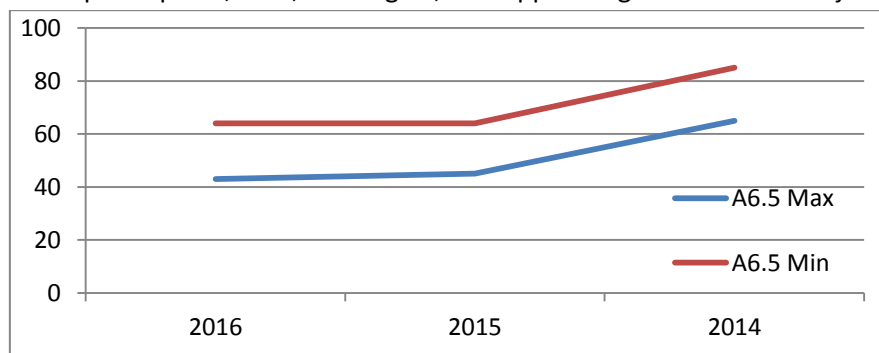


The number of manuscripts submitted is not very high, but if we except Jerusalem, and (once again) Guadalajara), it is in the range of 20 papers with 10 selected, which is quite normal.

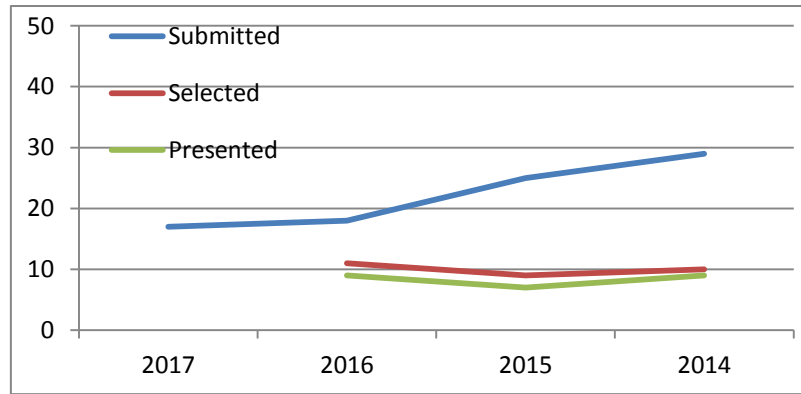


As it always gathers 50 to 60 participants, and deals with the fundamentals of the space debris problematics, A6.4 appears as a key session which could benefit from a slight redefinition, for instance through a clearer opening to the key questions of today : cubesats, mega-constellations, aso.

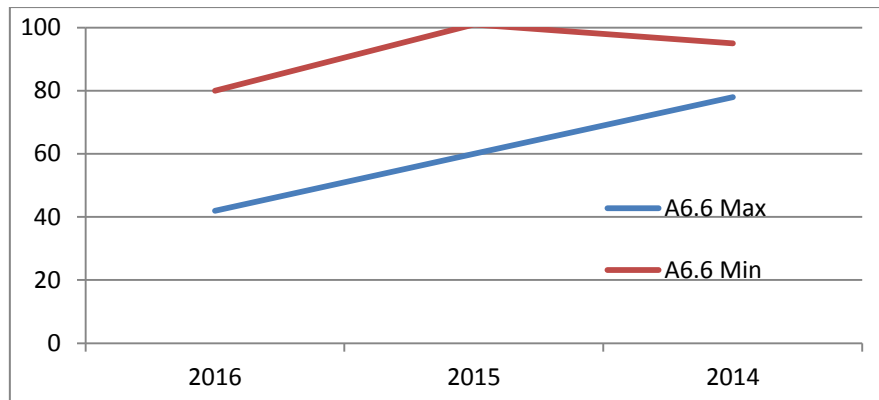
- A6.5 “Space Debris Removal Technologies” was initiated in 2014, replacing a more general A6.5 “ADR general issues”. It turned out to be quite successful since the beginning. Scores in the range of 60 participants, with, once again, a disappointing score in Guadalajara.



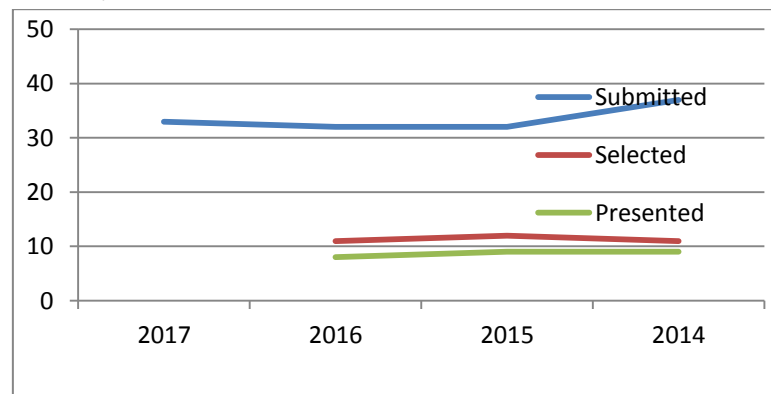
With an average rejection rate of 55%, A6.5 is definitely one a very good session; the anomaly in Guadalajara shall be understood... It is a very promising session in the future, as all these ADR technologies are under development and demonstration, so it has to be given a good priority in the coming years.



- A6.6 “Space Debris Removal Concepts” was also initiated in 2014 and appears as the most successful session of our symposium. A6.5 and A6.6 are in reality two “sister” sessions where papers are distributed between the two in order to have an attractive subject; ( It could have been, as for other symposia, “ADR# 1” and “ADR#2”). The average number of participants was over 80 in both Toronto and Jerusalem; it is very surprising to see it falling to 61 in Guadalajara despite a record overall participation; IAF secretariat has to come with an explanation!

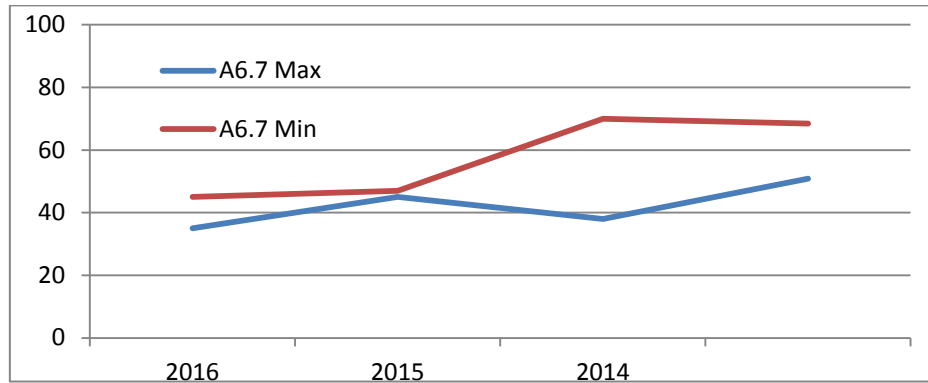


The topic of A6.6 is very good, modern, active, and will remain attractive over the coming years. The average rejection rate is 60%, which is very good. We could almost have identified a new session on ADR, in addition to A6.5 and A6.6!

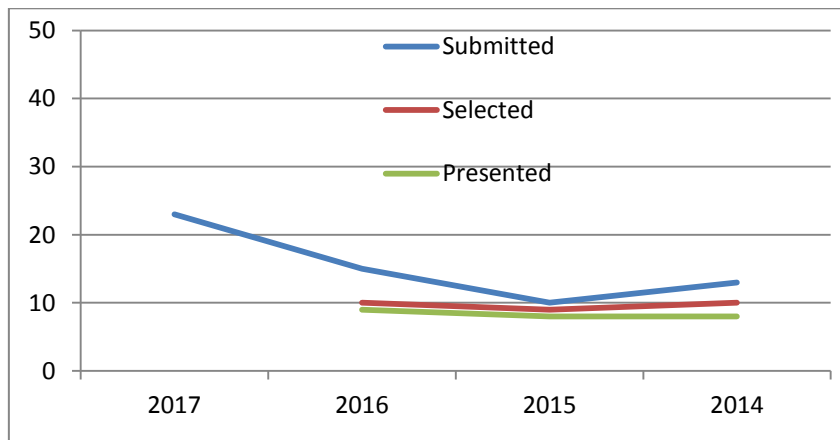


- A6.7 “Operations in Space Debris Environment, Situational Awareness” was initiated in 2014 to take into account the great success of A6.1 “Measurements” which always had a very large number of papers submitted. As explained previously, we chose to have the “scientific” part of the topic in A6.1, and the “operational” part in this new session. The attendance is

globally good, with an average of 59.6. As previously said, abnormally disappointing in Guadalajara.

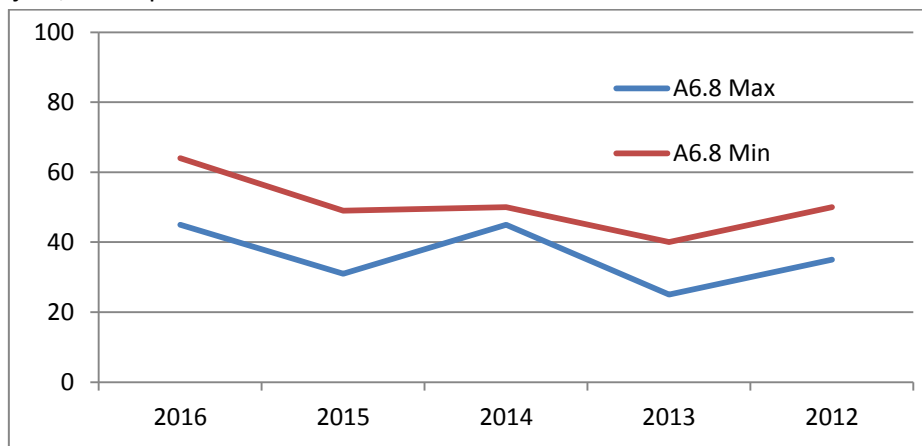


As it is a relatively new session, with papers coming from A6.4 and A6.5, its rejection rate is low, which is normal...



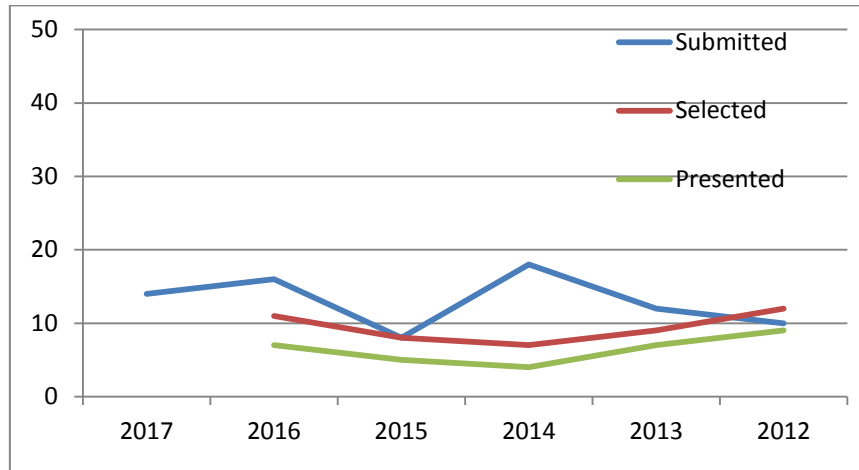
With all the progresses going on currently in the domain (new fence in US, SSA in Europe, private initiatives...) this session appears as a very promising one for the future.

- A6.8 "Policy, Legal, Institutional and Economic Aspects of Space Debris Detection, Mitigation and Removal" is a joint session with the "space security" committee, initiated in 2012. It is very specific, dealing with non-technical topics, traditionally held on Friday afternoon. Under the initiative of our colleagues from "space security", it turned out to be a very good initiative, with more than 40 participants in average. Strangely, the score was much higher in Guadalajara, with up to 64 attendees.

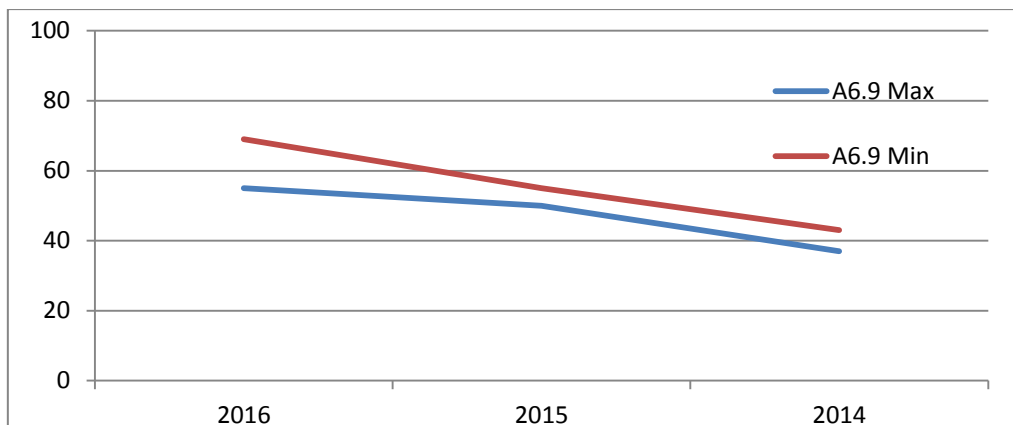




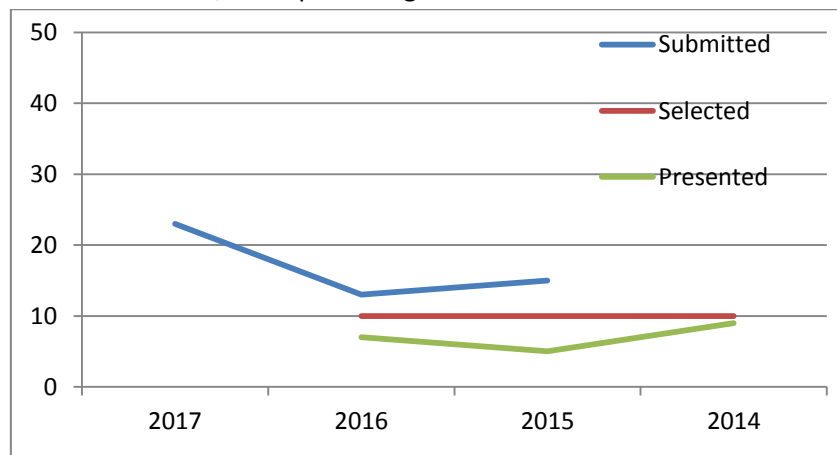
The rejection rate is not very high, but it is not abnormal considering the high specificity of the topic. It is a perfect example of a successful joint session.



- Last, A6.9 “Modelling and Orbit Determination” emanates from A6.2 “Modeling and Risk Analysis”. Initiated in 2014, it deals with the “operational” aspects of orbit determination, as A6.2 is much more “scientific”; they are clearly on two different topics. It met a good success, with an increasing number of attendees, even in Guadalajara with an average of 62...



As it is a relatively new session, it is not yet well known from the congressists, which implies a low rejection rate. Nevertheless, as this topic is a very modern one, with numerous initiatives at worldwide level, it is a promising one.



## Synthesis

- Globally, all the sessions behave more or less the same, with a good participation in the order of 52 in average, and peaks over 100. This constant number of attendees should be balanced with the increasing number of congressists every year, so a clear action should be set on IAF secretariat to understand where all the thousands of peoples spend their days...
  - Our 9 sessions are quite well equilibrated, and there is no need to have additional ones, with the exception of punctual joint session, as is proposed in Adelaïde together with “small satellites” community. They cover clearly distinct topics, with potentially the exception of A6.5 and A6.6. Participation is good everywhere, with the exception of A6.3 where a dedicated action has to be undertaken at Space Debris committee
- ➔ It is highly recommended not to change anything, with potentially an evolution of A6.3.