



Synthesis of the Space Debris Symposium, after analysis of data from 2011 to 2018

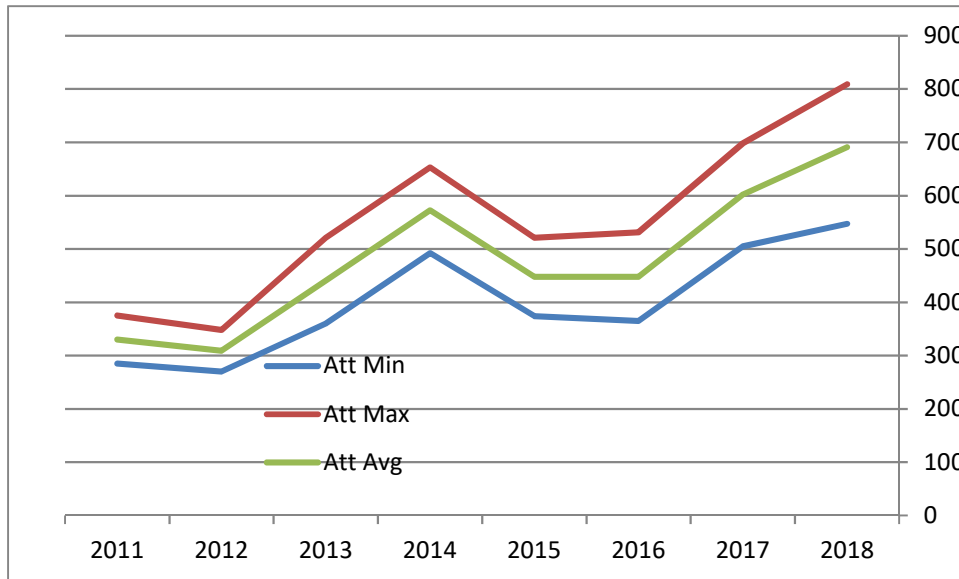
Note: Some figures in the following pages are not always completely coherent. This is normal, considering the Posters (not yet taken into account in this edition), as well as manuscripts proposed to other symposia during the March meeting, or on the contrary welcome in A6. The trends presented here are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

General statistics of the symposium:

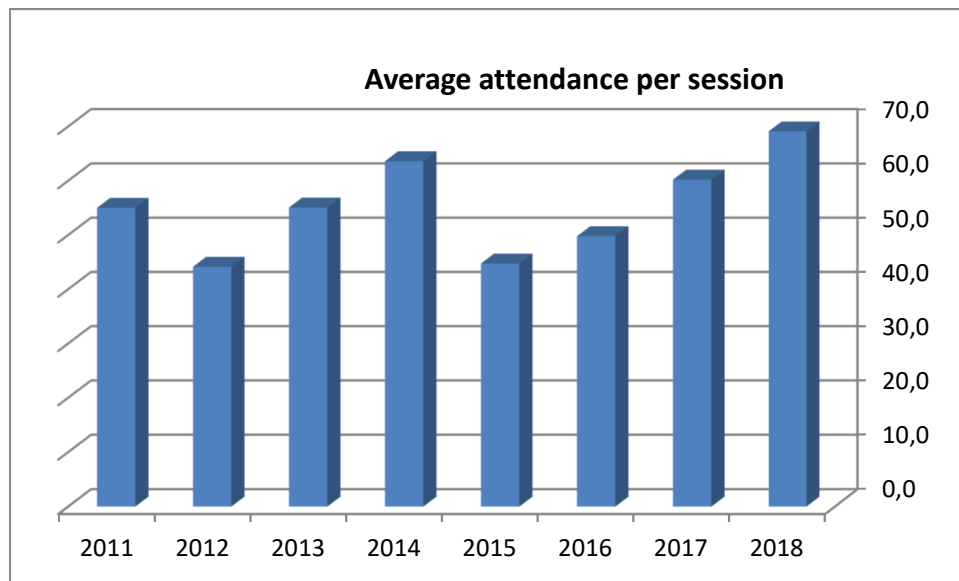
- There is a progressive increase in number of sessions from 6 to 10 (3 in 2000), sound and stable. When there are 10 sessions, it includes 2 Joint sessions, one classical one (A6.8) with the Space Security Committee, and one “rotating” (A6.10) with a different Committee every year. It is nevertheless widely agreed that there should not be any additional sessions.

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
69th	2018	Bremen								Joint		Joint
70th	2019	Washington								Joint		Joint

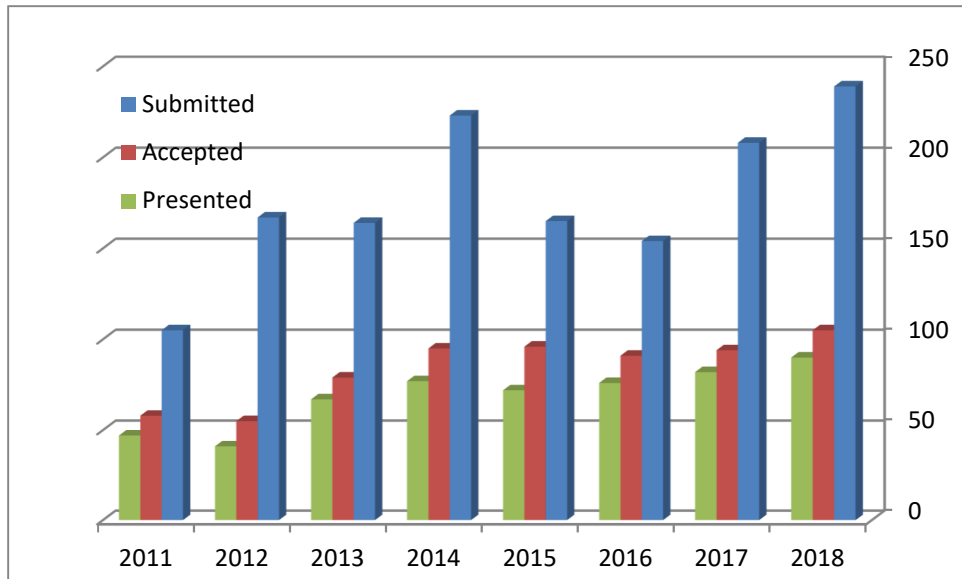
- The attendance to A6 sessions is globally very good and increasing; it is usually among the 3 highest of the Congress. The following diagram presents the sum of the number of participants to all the A6 sessions, over the years. Looking at the average attendance ((min + max)/2), it has an average value of 450 since 2011. Peak of this average was 691 in Bremen.



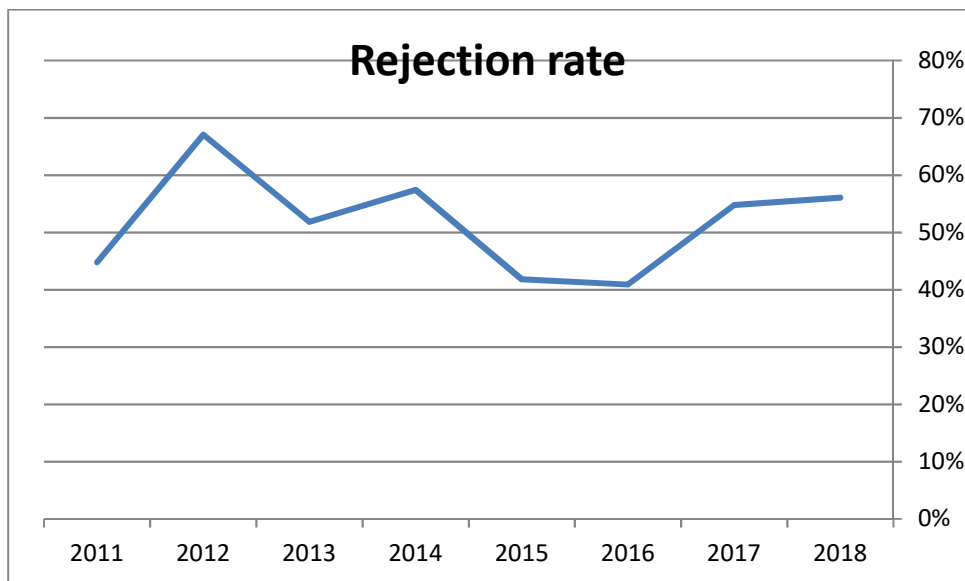
- The attendance per session is also important, and is different from the previous curve as the number of sessions has increased over the years. Double average (over sessions and over years) attendance is 53.4 participants per session (YPVF 2015 excluded); stable values, with only little variations from low 45 (Naples, Jerusalem) to high 69 (Bremen). Toronto was the second best ever with 63.4.



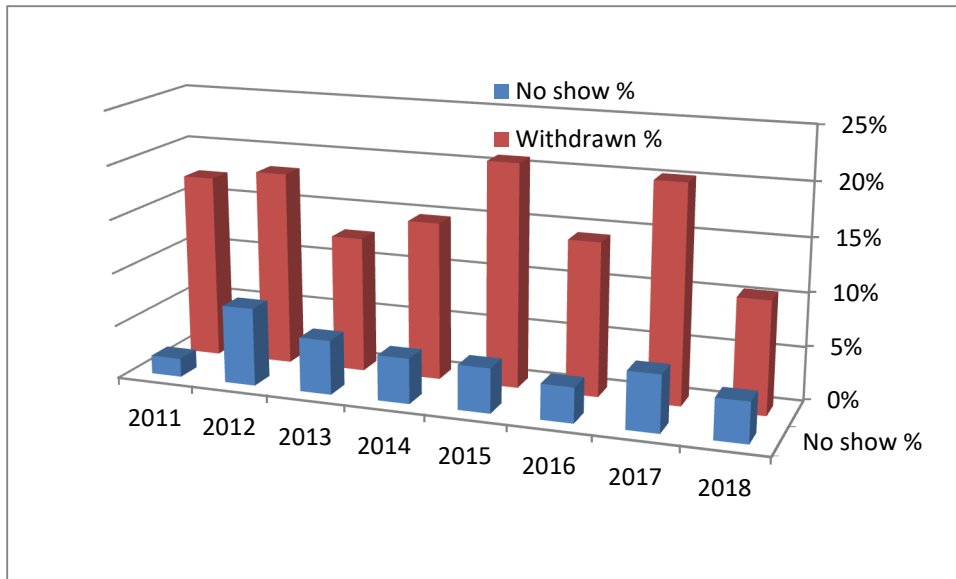
- In average, there have been 169 submissions, with a maximum ever of 239 for Bremen.



- The rejection rate is good, with an average over the years of 51%; one submission out of two is selected, which is sound for a scientific congress. The score was slightly higher in Bremen, which is good.



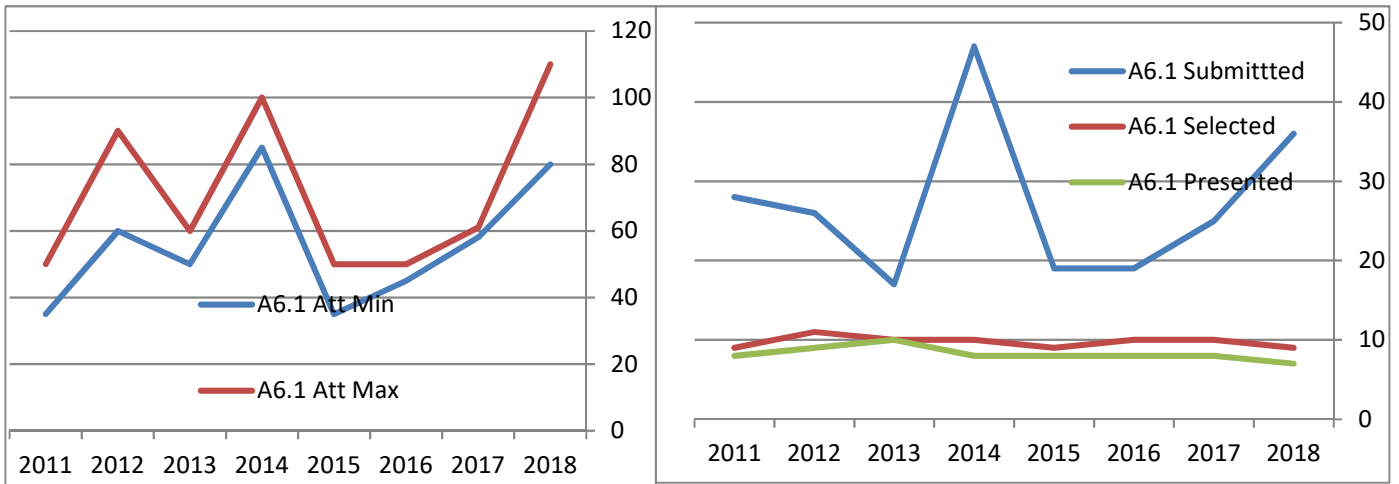
- The number of Withdrawn and No-Shows is relatively low, with an average of 17% and 4% respectively, but was a bit high in Adelaide, with 19 withdrawals and 5 No-shows (20% and 5%). This was probably due to the location of the congress, as these figures turned out to be much better in Bremen, with 11 withdrawals and 4 No-shows (10% and 4% respectively),





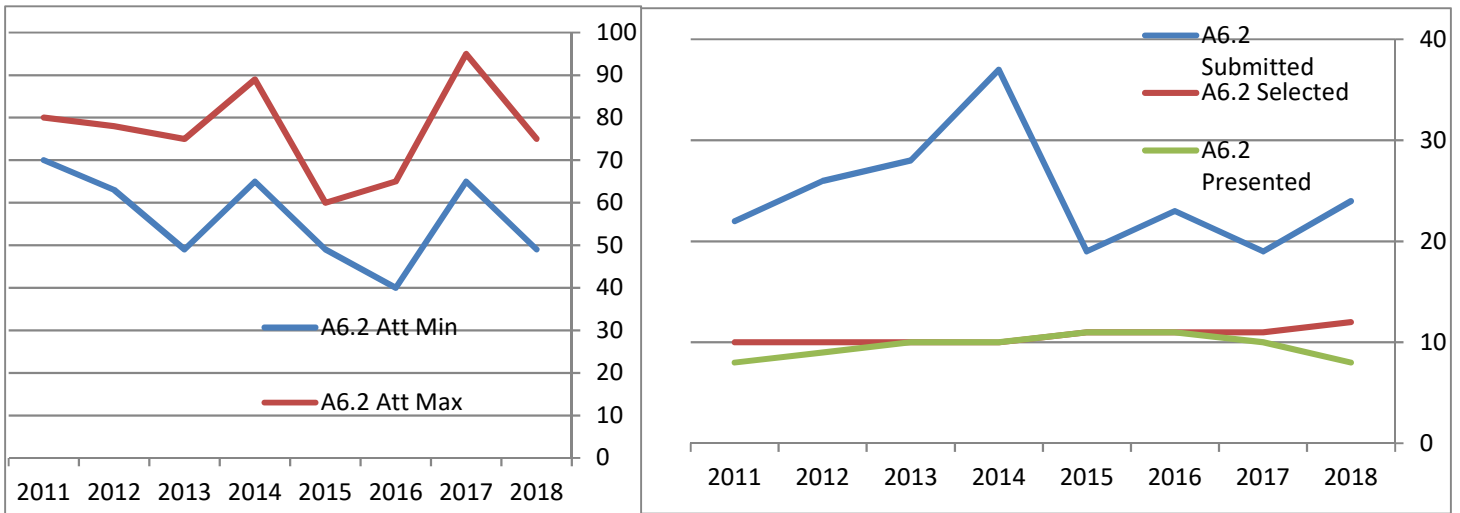
Analysis per session:

- **A6.1 “Space Debris Detection, Tracking and Characterization”** is a very specialized session which has always met a good participation, with an average of 64 attendees over the years.
- The hole in 2015 corresponds to the creation since Toronto (79% rejection!) of the new session A6.7 “Operations in Space Debris Environment, Situational Awareness” precisely with the goal of relaxing a bit A6.1, so it is more than normal (A6.1 remaining the “scientific one, A6.7 being more on the operational side). Ever since, nevertheless, the attendance has kept increasing.
- The number of submissions is high, 27 in average, and increasing these last years with a peak at 3è in Washington.



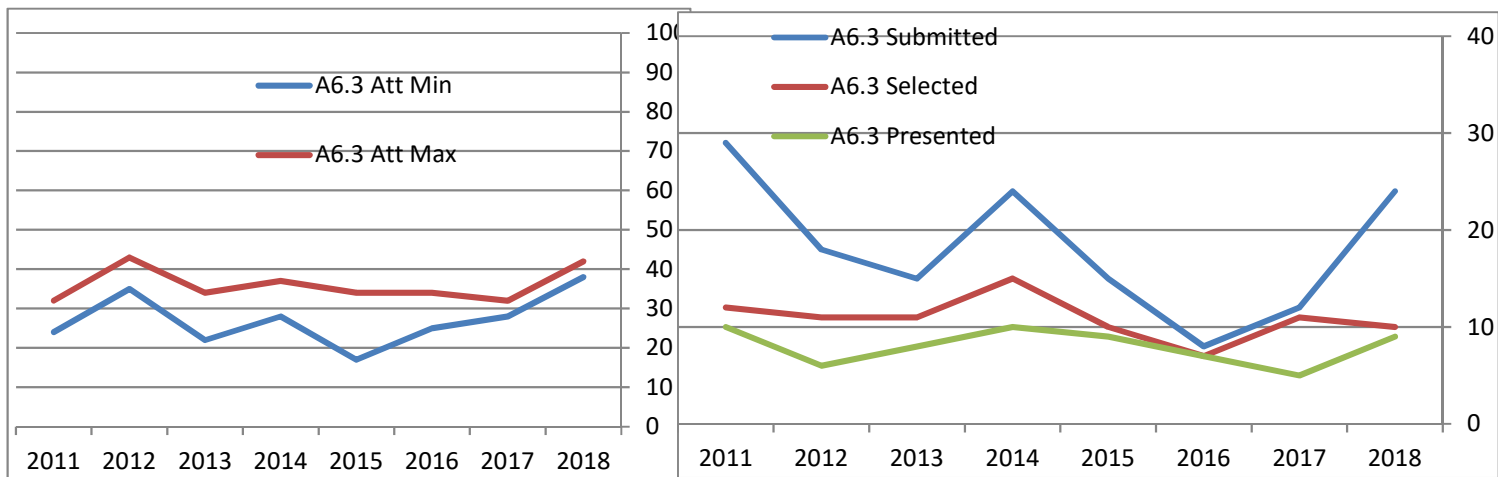


- **A6.2 “Modeling and Risk Analysis”** is also a “classical” session, always very well attended, with an average of 67 attendees, increasing these last years to reach an average attendance of 80 in Adelaide.
- As for A6.1, following the great success of Toronto where 73% of the submissions had to be 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. This explains the hole in 2015, both in terms of submissions and participants, from 2015 to now.
- With its very high rejection rate and very good attendance, there seem to be no need for an evolution of this session.



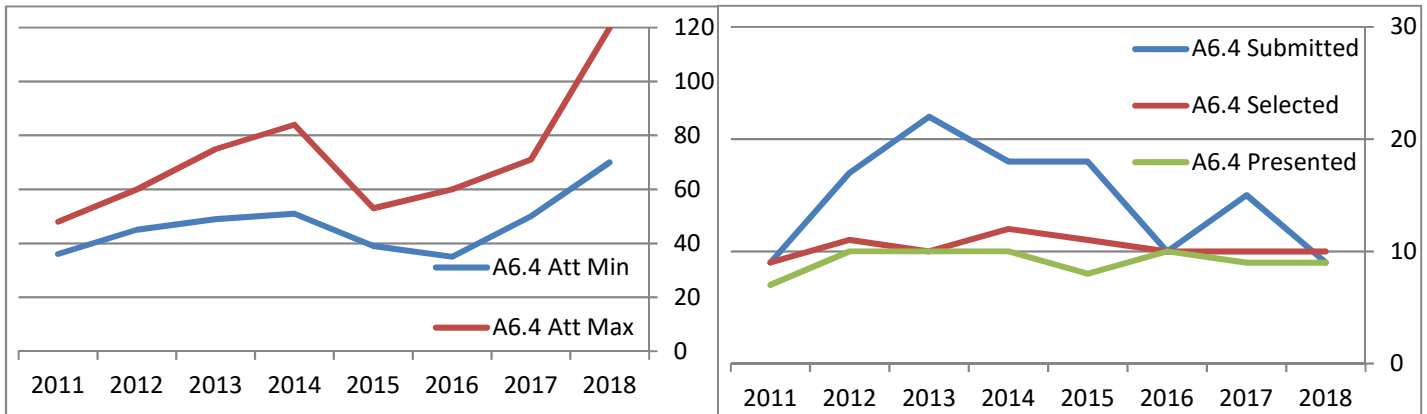


- **A6.3 “Hypervelocity Impacts and Protection”** is a highly specialized session dealing with ballistic limit equations and tests, unique to the domain. It is important to have such a high level technical session even if it means that mostly experts of the topic will attend. It leads to a slightly lower but stable participation compared to other sessions, 30 in average, due to this high degree of technicity.
- The number of papers submitted has been steadily decreasing these last years, very low in Guadalajara, but was better in Adelaide.
It was then decided to change the scope of the session and to broaden it to **“A6.3 Impact-Induced Mission Effects and Risk Assessments”** for Bremen. This change appears to have been positive, as there are 24 submittals this year, 2 times more than for 2017, and 3 times more than for 2016.
- The No-shows and Withdrawn have to be improved; in Adelaide, only 5 papers have been presented out of 11 selected. It is necessary to have a better selection, which should now be easier with a larger number of proposals.
- In Bremen however, the score was much better, with a trend to a very “normal” session



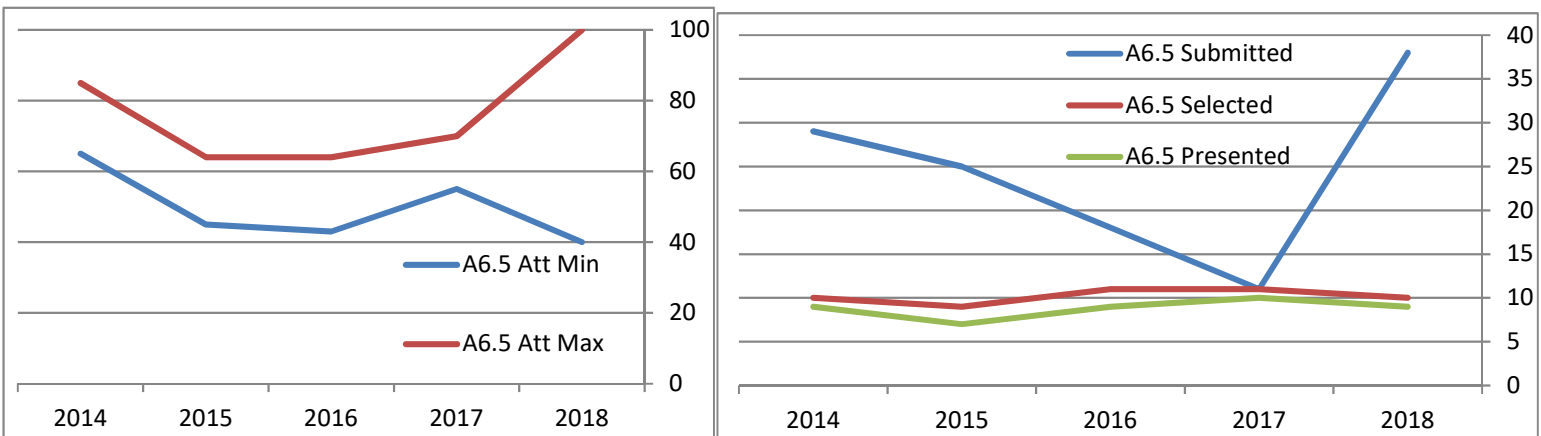


- **A6.4 “Mitigation and Standards”** is a historical “classical” session.
- It was so successful over the years that it led to a general redefinition of the other sessions from 2014 on, with numerous papers which were originally in A6.4 dispatched in A6.5, A6.6 and A6.8; this explains partially the 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 gathered a very good average of 54 since 2011, with an average of 62 in Adelaide, which is excellent.
- In order to improve the submission rate, it was decided for Bremen to slightly broaden the scope to **“A6.4 Mitigation and Standards: status, lessons learnt and future with smallsats and constellations”**. Despite this, the number of submissions for Bremen is low, with only 9 proposals. We need to see how to improve even more the submission rate.
- Despite the slight submission problems, A6.4 remains a very popular session over the years, well attended with over 120 max attendance.



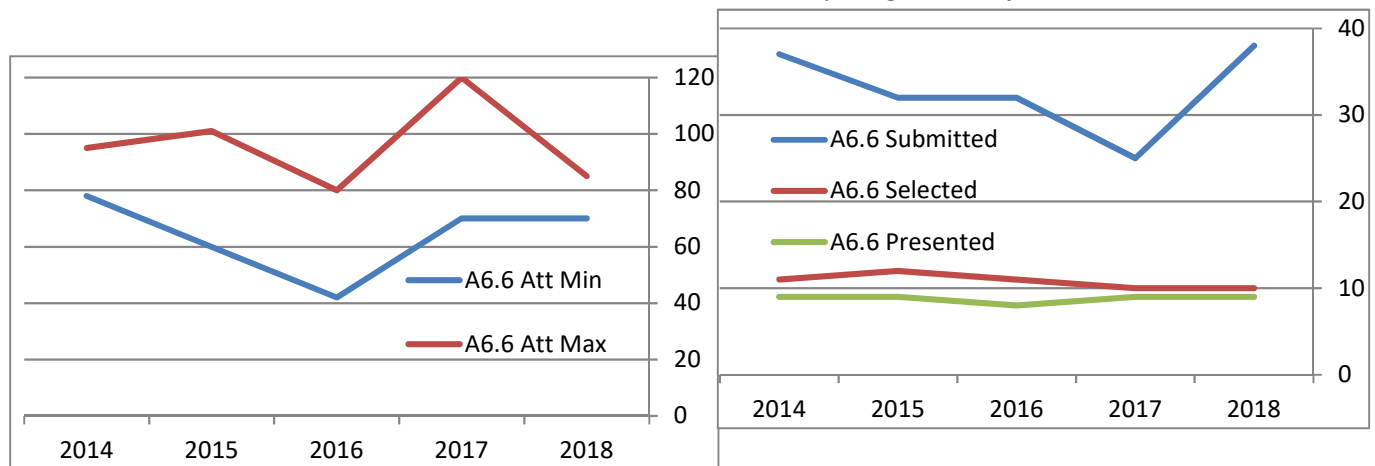


- **A6.5 “Space Debris Removal Technologies”** was initiated in 2014, replacing a more general A6.5 “ADR general issues”.
- It turned out to be quite successful since the beginning. The average attendance, 61.5, has been increasing these last years, with 63 in Adelaide, which is excellent.
- The average rejection rate is high, 58%, but has strongly dropped these last years, which is quite strange. This can be understood as there was confusion between A6.5 (Technologies) and A6.6 (Concepts), very close to each other. For instance, considering the sum of these two sessions in 2017, there were 36 submittals, 21 selected, 42% rejection which is very normal. It was therefore decided in 2017 to change the scope of both sessions and call them both **“Post Mission Disposal and Space Debris Removal”**. For this reason, in the following diagram, the number of papers submitted is the average between A6.5 and A6.6, not the real figure which has no meaning.
- With a very good submission rate, therefore rejection rate as well, and with peaks up to 100 attendees in Bremen, A6.5 is an excellent session and there is no need for an evolution.



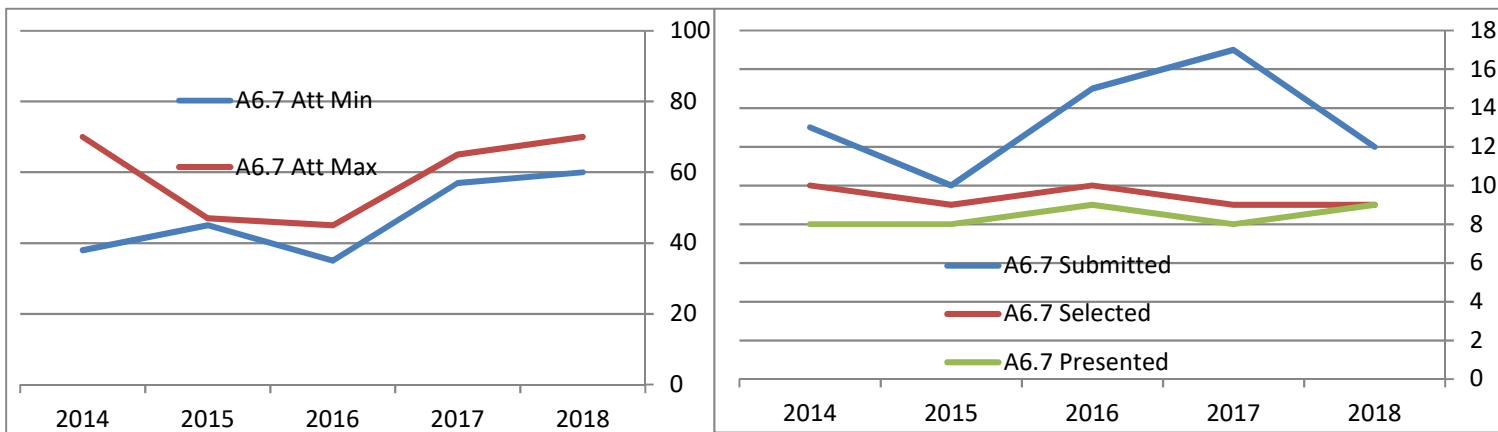


- **A6.6 “Space Debris Removal Concepts”** was also initiated in 2014 and appears as the most successful session of our symposium.
- As explained previously, A6.5 and A6.6 are in reality two “sister” sessions where papers are distributed between the two in order to have an attractive subject. For this reason, it has been renamed, as A6.5, for the Bremen congress **“Post Mission Disposal and Space Debris Removal (2)”**.
- The average number of participants is 81 since 2014, and has reached 95 in Adelaide, with a maximal peak of 120 attendees in the room but it dropped significantly to around 80 in Bremen.
- The topic of A6.6 is very good, modern, active, and will remain attractive over the coming years considering all the actions on-going in the field of Debris Remediation. The average rejection rate is 66%, which is high; it was problematic in Bremen where a total of 76 abstracts have been submitted for A6.5 and A6.6, for a total of 20 slots, therefore requiring a 74% rejection rate!



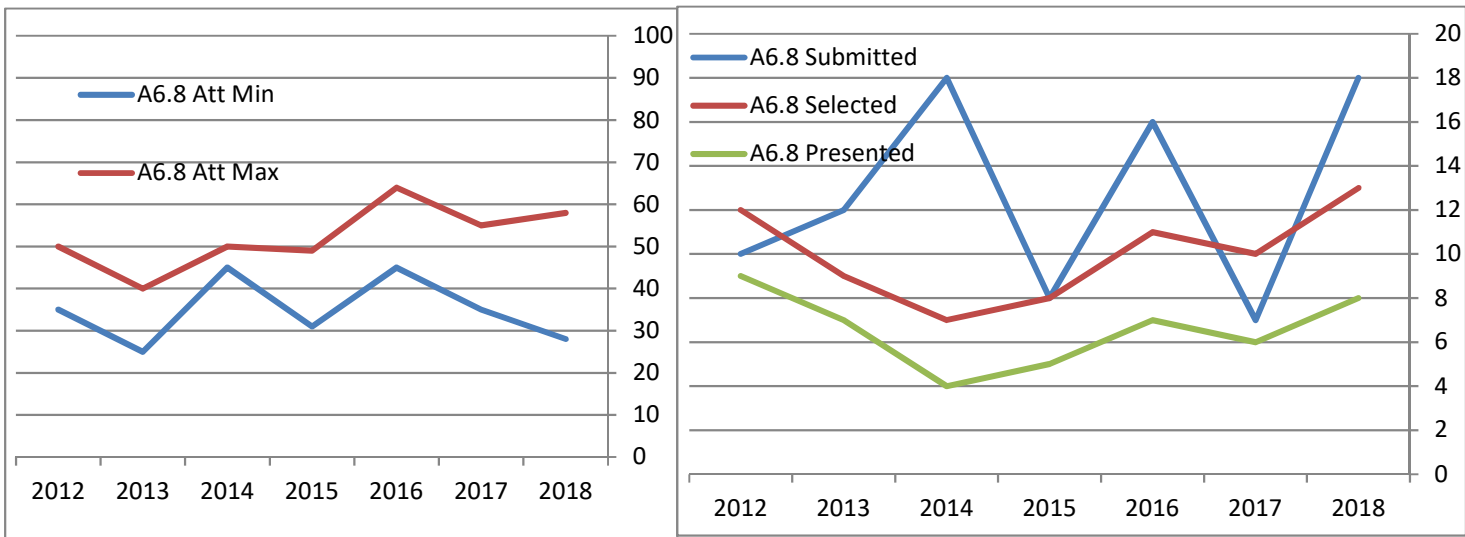


- **A6.7 “Operations in Space Debris Environment, Situational Awareness”** was initiated in 2014 to take into account the great success of A6.1 “Measurements” which always had a very large number of papers submitted.
- As explained previously, we chose to have the “scientific” part of the topic in A6.1, and the “operational” part in this new session.
- The attendance is globally good, with an general average of 51 which increased last year to reach 61, up to more than 75 in Bremen, showing clearly the interest of our participants for these SSA topics.
- The rejection rate was fair until 2017, 29% in average, with a high 47% in Adelaide, but lowered in 2018 as there were less submissions. However, it is possible that some of the 36 papers proposed for A6.1 may better fit in A6.9
- With all the progresses going on currently in the domain (new fence in US, EU-SST in Europe, private initiatives...) this session appears as a very promising one for the future.



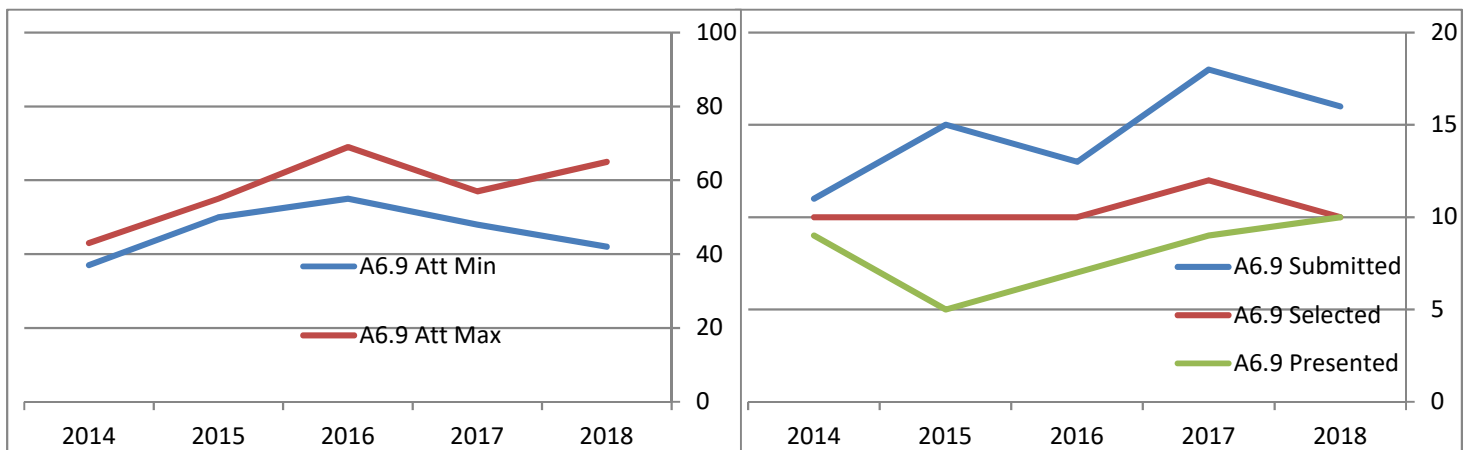


- **A6.8 “Policy, Legal, Institutional and Economic Aspects of Space Debris Detection, Mitigation and Removal”** is a joint session with the “space security” committee, initiated in 2012.
- It is very specific, dealing with non-technical topics, traditionally held on Friday afternoon. Under the initiative of our colleagues from “space security”, it turned out to be a very good session, with an average of 44 participants in average.
- The average rejection rate is 25%, but with very high variations which are not easy to understand...
- In addition, the withdrawal rate is high, with an average of 26%, in addition to 7% no shows. It is necessary to be cautious during the paper selection, identify back-ups, and contact the authors before the congress to make sure they will show-up.





- **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.
- So far it met a good success, with an stable number of attendees, 52 in average.
- As it is a relatively new session, it is not yet well known from the congressists, and the number of submissions (15 in average) is not yet what it could be for such an attractive topic, which implies a relatively low rejection rate, 28% in average.
- Nevertheless, as this topic is a very modern one, with numerous initiatives at worldwide level, it is a promising one.
- In 2018 for Bremen, the number of submissions is a bit lower than in Adelaide, but this may be due to the Joint Session A6.10-C1.7 that we have with the Astrodynamics Symposium which may have attracted some abstracts?
- It could be wise to redefine slightly the text of the session in order to broaden a bit its scope and attract a bit more.

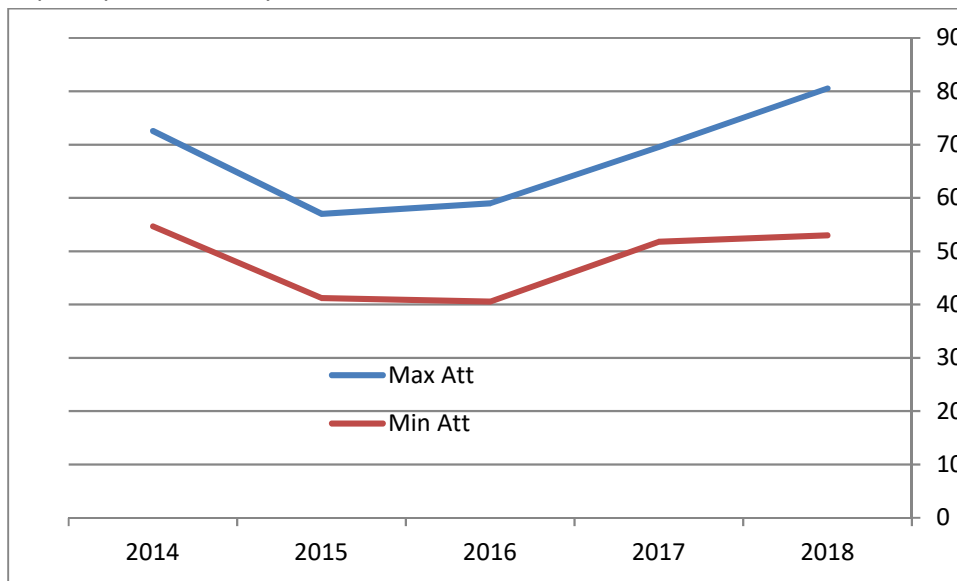




Synthesis

- Globally, all the sessions behave more or less the same, with a good participation in the order of 56 in average these 4 last years (without A6.10), and peaks over 120.
- It is difficult to interpret correctly these figures, as Jerusalem, Guadalajara and Adelaide all raised some travel problems, but Toronto 2014 and Bremen 2018 are comparable, even if 2018 was slightly better..

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 “classical” sessions are quite well equilibrated, and the modifications introduced in 2017 seem to have been fruitful.

➔ There is no need identified to modify significantly any of our sessions.