TESTORI
AERO SUPPLY

9th Triennial international aircraft fire and cabin safety research conference

Oct. 28-31, 2019
Atlantic City, NJ

NEW FRONTIER FOR FLAMMABILITY TESTING ON TRANSPORT AIRCRAFT

Andrea Scialpi
Testori Aero Supply

TESTORI
AERO SUPPLY

INDEX

TESTORI
AERO SUPPLY

PROJECT DEVELOPMENT (1/2)

- Airplane cabin interiors are designed to be safe, comfortable for passengers and to comply with EASA/FAA requirements of 25.561 and 25.562 concerning crashworthiness and 25.853 concerning flammability. These conditions must be continuously respected during the entire life of the aircraft, thus whenever a part is replaced due to rupture or worn-out.
- While an aircraft and a seat structure average life is between 20 and 30 years, the seat system is weak on the cosmetics aspects since the seat covers and the seat cushions are prone to deterioration mainly due to use and passengers' abuses and are linked to airline logos and/or marketing campaigns and are the easiest and cheapest parts to be replaced.
- Like all cabin interior components, also seat covers need to be certified for each specific seat and cushion model, and must prove being flame-retardant, upon a vertical flammability test on the cover materials, and an Oil Burn Test (OBT) performed on the seat cover applied to the original cushion, according to FARCS 25.853. Their renovation, especially for aircrafts aged more than 10 years (~65% of circulating airplanes), can be quite expensive since technical and testing problems related to the traceability of the original flammability are very often faced by design organizations.
- Grasping the market needs, Testori Aero Supply (TAS) has discussed with EASA an innovation-driven solution to the retrofit problem, which will drastically reduce flammability certification time and costs for aircraft seat leather covers, and will break the deadlock imposed by the outdated flammability test regulation (AC25.853) issued in 1986 and never upgraded, to keep pace with innovations in leather material production and finishing processes.

TESTORI
AERO SUPPLY

PROJECT DEVELOPMENT (2/2)

- The idea is to validate leathers of the most used colours installed on the most used cushions, produced by major world leather and cushions providers and assess their “similarity” for flammability certification allowing production and installation without the need of OBT.
- At present no such processes have been validated nor are EASA/FAA certified for different leathers and different airplane seat cushions.
- TAS has already verified the proposed approach in the frame of more than 1,000 flammability tests (OBT) performed since 2009 to fulfil client's urgent orders, under the umbrella of EASA approved "prototyping" procedure, allowing a pre-production of seat covers in parallel to flammability test. The so defined innovative process will open new market opportunities for both aircraft interiors retrofit companies and leather producers.
- With this project TAS addresses this market need and proposes a new certification process allowing the replacement of all types of seat covers compliant to FAA/EASA safety regulation FAR CS 25.853, without the need of flammability testing (OBT).

CURRENT FLAMMABILITY REGULATION (1/3)

U.S Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject:	FLAMMABILITY REQUIREMENTS FOR AIRCRAFT SEAT CUSHIONS	Date: 9/17/86 Initiated by: ANM-110	AC No: 25.853-1 Change:

1. PURPOSE. This Advisory Circular (AC) provides guidance material for demonstrating compliance with the Federal Aviation Regulations (FAR) pertaining to flammability of aircraft seat cushions. This AC also defines certain terms used in the FAR, in the context of these requirements.

2. RELATED FAR SECTIONS.

a. Section 25.853 of Part 25 of the FAR - Compartment Interiors.

b. Appendix F--Part II, of Part 25 of the FAR - Flammability of Seat Cushions.

c. Section 29.853 of Part 29 of the FAR - Compartment Interiors.

d. Section 121.312 of Part 121 of the FAR - Materials for Compartment Interiors.

e. Section 135.169 of Part 135 of the FAR - Additional Airworthiness Requirements.

3. BACKGROUND.

a. On October 23, 1984, the Federal Aviation Administration (FAA) issued Amendments 25-59, 29-23, and 121-184 which became effective November 26, 1984. These amendments are part of the FAA's continuing efforts to upgrade aircraft cabin safety and improve occupant survivability in aircraft accidents. They require that seat cushions installed on transport category airplanes and rotorcraft meet improved flammability standards.

b. Amendments 25-59, 29-23, and 121-184 were issued to require that new type design transport category airplanes and rotorcraft, as well as aircraft in air carrier operation under Part 121 and large airplanes operated under Part 135, be equipped with seat cushions providing a high degree of fire-resistance. Affected operators are required to comply with these amendments after November 26, 1987.

4. OBJECTIVE OF THE RULE.

a. Full-scale and laboratory fire testing conducted by the FAA has demonstrated that the involvement of the relatively large mass of foam

cushion material in aircraft is a major factor in a cabin fire. Thermal radiation can penetrate the seat's outer upholstery covering and cause ignition of the foam core. Due to the quantity of foam material used in aircraft, this potential fuel source can cause a fire to spread throughout the cabin and produce large amounts of smoke and toxic gas emissions.

b. One concept for retarding the involvement of seat cushion foam in a cabin fire is the fireblocking layer. This concept involves the use of a thin layer of highly fire-resistant material to encapsulate the foam mass and protect it from external fire sources. Research and development by the FAA confirmed the viability of the blocking layer concept and produced a new test method to ensure adequate fire protection is provided for particular seat cushion configurations. The new test method utilizes a two gallon per hour oil burner operating at temperatures and heat flux levels representative of a cabin fire. Seat cushions which pass this test provide substantially improved fire safety in aircraft cabins.

5. DISCUSSION OF TERMS USED IN PART 25, APPENDIX F--PART II.

a. Back Cushion Specimen. The back cushion specimen, as referred to in paragraph (a)(1), means the cushion specimen in the vertical orientation. This specimen may be representative of either the production seat back or seat bottom (or both, if the production articles have the same construction). This specimen is hereafter referred to as "the vertical specimen."

b. Bottom Cushion Specimen. The bottom cushion specimen, as referred to in paragraph (a)(1), means the cushion specimen in the horizontal orientation. This specimen may be representative of either the production seat back or seat bottom (or both, if the production articles have the same construction). This specimen is hereafter referred to as "the horizontal specimen."

c. Specimen Set. As used in paragraph (a)(1), a specimen set consists of one vertical specimen and one horizontal specimen. Both specimens represent the same production cushion construction; that is, both specimens in the specimen set have identical construction and materials, proportioned to correspond to the specimen size (see figure 1).

d. Similar Dress Covering.

(1) Similar, as used in paragraph (a)(3), refers to dress covering materials having the same material composition, weave style, and weight. Material blends may be considered similar when the constituent materials' fractions are the same, ±6 percent, as the tested material. Examples of different weave styles include: plain, jacquard, or velvet. With regard to weight, lighter fabrics are generally more critical than heavier fabrics. Due to the severe shrinking and unpredictable distortion experienced by leather dress cover materials, similarity approvals for leather are not recommended.

New frontier for flammability testing on transport aircraft

TESTORI
AERO SUPPLY

CURRENT FLAMMABILITY REGULATION (2/3)

- TAS has already verified the proposed approach in the frame of more than 1,000 flammability tests (OBT) performed since 2009 to fulfil client's urgent orders, under the umbrella of EASA approved "prototyping" procedure, allowing a pre-production of seat covers in parallel to flammability test. The so defined innovative process will open new market opportunities for both aircraft interiors retrofit companies and leather producers.
- With this project TAS addresses this market need and proposes a new certification process allowing the replacement of all types of seat covers compliant to FAA/EASA safety regulation FAR CS 25.853, without the need of flammability testing (OBT).

TESTORI
AERO SUPPLY

CURRENT FLAMMABILITY REGULATION (3/3)

d. Similar Dress Covering.

(1) Similar, as used in paragraph (a)(3), refers to dress covering materials having the same material composition, weave style, and weight. Material blends may be considered similar when the constituent materials' fractions are the same, ±6 percent, as the tested material. Examples of different weave styles include: plain, jacquard, or velvet. With regard to weight, lighter fabrics are generally more critical than heavier fabrics. Due to the severe shrinking and unpredictable distortion experienced by leather dress cover materials, similarity approvals for leather are not recommended.

(2) Certification by similarity to previously tested dress covers should be limited to instances where the material composition is the same, and the weight and weave type are essentially the same. In all cases, results of the bunsen burner test per § 25.853(b) for the new material should be equal to or better with respect to burn length than the tested material. In addition, it may be useful to evaluate the weight loss and burn length results of the oil burner test to determine if the tested material is a good basis for similarity; that is, the closer weight loss and burn length with the oil burner are to the maximum allowed, the more alike the dress covering materials should be for similarity. In general, test data and resultant experience gained from conducting tests will also be a major source of information to determine if approval by similarity is acceptable.

BRIEF HISTORY OF LEATHER TREATMENTS (1/5)

The tanning process of the leather heights is one of the most ancient “industrial” treatments developed since ages to allow humans to use it as cloths and protections.

In the last ages, besides mandatory preliminary cleaning from muscle and tendons remains, various different methods for treatment are applied, such as:

- **Tanning by Smoking and/or using salt/alkaline solutions**
- **Vegetal and/or barks Tanning**
- **Tanning by Dung**
- **Chrome Tanning**

BRIEF HISTORY OF LEATHER TREATMENTS (2/5)

TANNING BY SMOKING

After the cleaning and smoothing phases, the hides were undergoing a smoking treatment to get them more resistant to environment agents, to mosquito bites, to mildews.

The smoked hides were also waterproof and it was possible to clean them with fresh water.

The smoking treatment was lasting 30-60 minutes.

The fire used to smoke the leather was made of a mixture of dry and fresh wood to maximize the production of smoke and was kept at the lowest regime to minimize the flames height that could damage the leather.

BRIEF HISTORY OF LEATHER TREATMENTS (3/5)

VEGETAL OR BARK TANNING

In this process delimed hides and skins, technically called “the prepared pelt”, are treated with and infusion of tanning containing vegetal matter. Many barks, fruit, wood, and leaves containing tanning and these are known as tanstuffs or tanning material.

The tanning is extracted from tanstuffs with water and the aqueous tanning extract is called tan liquor.

The process consists in the treatment of the pelt in tan liquors of gradually increasing strength, starting in the weakest and finishing in the strongest liquor. The strongest liquor is drawn from the head leach and during the process of tanning imparting its tannin to hides, it gradually gets reduced in strength and finally becomes a weak or tail liquor, which is then run down the drain

With this treatments the leather becomes waterproof, strong and gets a brown colour.

This process is still in use on some nice highest quality market since it is the more environmentally friendly alternative, the so called FOC, to the most commonly used chrome tanning.

BRIEF HISTORY OF LEATHER TREATMENTS (4/5)

TANNING BY DUNG

For leathers which have to be soft pliable and more or less stretchy all the four objects of deliming must be fulfilled and this cannot be achieved by any chemical deliming agent. Bacterial action is necessary and from time immemorial fermented infusion of hen and pigeon dungs or of dog dungs have been used for the purpose. When deliming is done by hen or pigeon dung the process is called bating.

The action of the bird manure is comparatively mild and this method has been found suitable for cow hides and calf skins. When an infusion of dog dung is used the process is called “puering”.

The action of the dog dung is vigorous and it softens down the hardest skins.

BRIEF HISTORY OF LEATHER TREATMENTS (5/5)

CHROME TANNING

The chrome tanning is a nowadays the most common industrial process according to which the tanning is dome by a basic chrome salt.

Chrome tanning with chromium salts accounts for around 85 percent of global leather production (as of 2016).

95% of shoe upper leather, 70% of leather upholstery (but decreasing in favour of FOC-leather) and almost 100% of clothing leather are chrome tanned.

Although it has twice the tensile strength of vegetable tanned leather, chrome-tanned leather weighs less because the skin does not fully absorb the chromium salts used for tanning. The tannin makes up just 4% (with newer leathers only about 1.5%) of the leather weight, while it is approx. 20% on the vegetable tanned leather.

Chrome-tanned leather is more easily hydrophobized compared to other tanning alternatives and the leather can be softened more easily.

The tanning process is faster and requires less tanning chemistry than vegetable tanned leather.

Cost saving: freshly tanned wet-blue with its characteristic bluish tint is globally transportable and can be stored well.

This facilitates unlimited international sales and global processing.

The chrome tanning process can be considered a totally controlled industrial process regulated by international protocols and methods.

TESTORI
AERO SUPPLY

CURRENT LEATHER TREATMENTS (1/3)

In the pictures below and in the next pages are shown the most common industrial processes for chrome tanned leather heights. In particular, all these images are taken by the Mastrotto industries (TAS leather manufacturer) brochure.


1. Soaking


2. Pressing


3. Splitting


4. Shaving


5. Trimming


6. Dyeing

TESTORI
AERO SUPPLY

CURRENT LEATHER TREATMENTS (2/3)

7. Drying

8. Conveyor

9. Staking

10. Buffing

11. Fulling

12. Finishing

TESTORI
AERO SUPPLY

CURRENT LEATHER TREATMENTS (3/3)


13. Ironing


14. Trimming


15. Workshop


16. Selection


17. Measuring


18. Storage

TESTORI AERO SUPPLY FLAMMABILITY TEST RESULTS ANALYSIS (1/8)

Testori Aero Supply has created its own flammability Laboratory since day first and is an approved flammability test facility for Leonardo Helicopters and its interior subcontractors (SEI, MECAER, ADLER) as well as for other Production Organization, Italian and foreign.

To make a long story short we are considering the successful 1,215 OBT performed since 2009 through Aug. 31st, 2019. We have a total of successful tests while the fail tests have been approx. 7% to 9% of the total.

Among the 1,215 OBT performed 1,027 are with leather seat covers, approx. 84,52% of the total, divided in 4 macro different type of OBT.

The table below gives a preliminary picture of TAS experience on OBTs.

TYPE OF TEST	NUMBER	% OF THE TOTAL
OBT	**1,027**	**100**
TAS Leather - TAS Foam (TL-TF)	202	19.66
TAS Leather - Other Foam (TL-OF)	214	20.84
Other Leather - TAS Foam (OL-TF)	65	6.33
Other Leather - Other Foam (OL-OF)	546	53.17

TESTORI AERO SUPPLY

TESTORI AERO SUPPLY FLAMMABILITY TEST RESULTS ANALYSIS (2/8)

The table below gives the complete picture of TAS experience.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
OBT	**42**	**90**	**87**	**105**	**157**	**89**	**136**	**145**	**139**	**129**	**96**
L-OBT	**32**	**75**	**61**	**65**	**122**	**79**	**126**	**128**	**130**	**117**	**92**
TL-TF	0	6	6	6	26	23	11	36	34	38	16
TL-OF	17	19	12	12	11	7	25	35	29	24	23
OL-TF	0	0	0	0	3	2	7	16	21	8	8
OL-OF	15	50	43	47	82	47	83	41	46	47	45

TL = TAS Leather
TF = TAS Foam
OL = Other Manufacturer Leather
OF = Other Manufacturer Foam

TESTORI AERO SUPPLY FLAMMABILITY TEST RESULTS ANALYSIS (3/8)

When we consider the successful OBT test we have to consider the different variety.

It has been noticed in the years an increase on the percentage of the leather seat covers versus the fabric seat covers.

Among the third-party cushion foams there are:

FOAM	METZLER	GREINER	DAX	FRANKLIN	CARPENTER	VOTH & SOHN	VARIOUS
%	30	20	25	10	4	4	7

As “Various” foams TAS considers parts manufactured using products such as Starr, old foams obtained from cutting out spare cushions in accordance with AC 25.853.

Among the third-party leather there are:

LEATHER	PERRONE	FOGLIZZO	MUIRHEAD	COMPELL	SPYNNIBECK	LANTHAL	VARIOUS
%	25	25	15	10	10	5	10

As “Various” TAS considers products manufactured using leather such as AERISTO, Poltrona Frau, and some artificial leather.

TESTORI
AERO SUPPLY

TESTORI AERO SUPPLY FLAMMABILITY TEST RESULTS ANALYSIS (4/8)

Among all the leather seat covers OBT tests TAS, besides the 4 different key material combinations (TAS Leather and Foam, TAS Leather-Third Party Foam, Third Party Leather-TAS Foam, Third Party Leather and Foam), has identified three additional combinations that are adding some additional variations in the weight loss (most critical aspect of an OBT based on TAS experience) of the specimens. After the test we have noticed three main varieties:

COMBINATION	% OF THE OBT TOTAL (1,027)	WEIGHT LOSS %
Foam and Leather	8.88 (95)	9-9.99
Foam, Leather and FBL	42.77 (432)	7-9.95
Foam, Leather, FBL and Wadding	48.34 (500)	8-9.9

NOTE: FBL is a TAS manufactured FBL in 95% of the tests
Wadding is a TAS manufactured wadding in 95% of the tests

TAS does not consider the seat cover burn length as a critical aspect in an OBT.

The weight loss percentage is the most critical aspect for OBT success due to the constant efforts of the industry towards component weight reduction. This means lighter foams and less thick leather covers.

Additionally, the industry has developed new type of leather both synthetic such as Enduralite (Perrone) and natural minced together such as E-Leather.

In the next slide are reported the complete statistics of the TAS OBT.

TESTORI
AERO SUPPLY

TESTORI AERO SUPPLY FLAMMABILITY TEST RESULTS ANALYSIS (5/8)

YEAR			2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
OBT			42	90	87	105	157	89	136	145	139	129	96
L-OBT			31	74	61	65	122	81	126	128	130	117	92
TL-TF		204	0	6	6	6	26	25	11	36	34	38	16
	F+L	30	0	1	2	0	5	4	2	4	3	5	4
	F+FBL+L	79	0	4	4	4	8	9	4	15	13	15	3
	F+FBL+W+L	95	0	1	0	2	13	12	5	17	18	18	9
TL-OF		210	17	18	12	12	11	7	25	35	29	24	20
	F+L	24	2	2	2	1	1	0	2	3	2	2	7
	F+FBL+L	79	7	7	5	5	5	3	10	15	12	10	0
	F+FBL+W+L	107	8	9	5	6	5	4	13	17	15	12	13
OL-TF		69	0	0	0	0	3	2	7	16	21	8	12
	F+L	5	0	0	0	0	0	0	0	1	2	1	2
	F+FBL+L	27	0	0	0	0	1	1	3	6	8	3	0
	F+FBL+W+L	37	0	0	0	0	2	1	4	9	11	4	10
OL-OF		544	14	50	43	47	82	47	83	41	46	47	44
	F+L	35	2	3	3	4	4	3	5	3	3	5	0
	F+FBL+L	252	6	20	18	20	38	22	37	18	20	24	29
	F+FBL+W+L	257	6	27	22	23	40	22	41	20	23	18	15

TESTORI AERO SUPPLY FLAMMABILITY TEST RESULTS ANALYSIS (6/8)

Based on the past consolidated experience on OBT (1,027 TEST in 10.5 years), the test results displayed in the previous slides and considering the progress in the leather treatment TAS is proposing to seriously consider the possibility to apply the similarity concept to the leather seat covers replacement as well.

TAS has noticed that the key parameter (weight loss) for all the OBT performed are concentrated in a range between 7 and 9.99%, with a bigger concentration between 8.4 and 9.99%.

As it is possible to understand there is a variation of weight change in a range of 1.5%.

In the next slide are reported all the OBT on leather covers performed by TAS in 2019 divided by type and combination.

TYPE

TL-TF = TAS Leather/TAS Foam

TL-OF = TAS Leather/Other Foam

OL-TF = Other Leather/TAS Foam

OL-OF = Other Leather/Other Foam

COMBINATION

F+L = Foam and Leather

F+FBL+L = Foam, FBL and Leather

F+FBL+ W+L = Foam, FBL, Wadding, Leather

TESTORI
AERO SUPPLY

TESTORI AERO SUPPLY FLAMMABILITY TEST RESULTS ANALYSIS (7/8)

OBT	AV WEIGHT	% WEIGHT LOSS	FAM	TYPE	OBT	AV WEIGHT	% WEIGHT LOSS	FAM	TYPE	OBT	AV WEIGHT	% WEIGHT LOSS	FAM	TYPE
1	3540	8,36	OL-OF	F+FBL+W+L	36	5930	9,4	OL-OF	F+FBL+W+L	71	3505	8,23	OL-OF	F+FBL+W+L
2	4235	7,84	OL-OF	F+FBL+W+L	37	5860	9,49	OL-OF	F+FBL+W+L	72	5970	8,09	OL-OF	F+FBL+L
3	4140	7,58	OL-OF	F+FBL+W+L	38	3960	7,40	TL-TF	F+FBL+L	73	6540	8,44	OL-OF	F+FBL+L
4	3620	8,32	TL-OF	F+FBL+W+L	39	6000	8,82	OL-OF	F+FBL+W+L	74	5300	8,63	OL-OF	F+FBL+L
5	4280	7,40	TL-OF	F+FBL+W+L	40	5650	8,59	OL-OF	F+FBL+L	75	6020	8,8	OL-OF	F+FBL+L
6	4160	7,29	TL-OF	F+FBL+W+L	41	6010	9,18	OL-OF	F+FBL+L	76	6250	8,96	OL-OF	F+FBL+L
7	3685	7,63	TL-OF	F+FBL+W+L	42	5700	9,02	OL-OF	F+FBL+L	77	5960	8,59	OL-OF	F+FBL+L
8	4195	7,48	TL-TF	F+FBL+W+L	43	4340	8,75	OL-TF	F+FBL+W+L	78	3885	8,24	OL-TF	F+L
9	3660	8,22	TL-TF	F+FBL+W+L	44	4195	7,48	TL-TF	F+FBL+W+L	79	3880	7,96	OL-TF	F+L
10	5930	9	OL-OF	F+FBL+L	45	3660	8,22	TL-TF	F+FBL+W+L	80	3880	8,14	TL-TF	F+L
11	5590	8,61	OL-OF	F+FBL+L	46	5980	9,09	OL-OF	F+FBL+L	81	3860	8,06	TL-TF	F+L
12	3685	7,63	TL-OF	F+FBL+W+L	47	6100	8,73	OL-OF	F+FBL+L	82	3160	9,07	TL-OF	F+FBL+W+L
13	3460	8,09	TL-OF	F+FBL+W+L	48	5230	8,68	OL-OF	F+FBL+L	83	3020	8,87	TL-OF	F+FBL+W+L
14	4140	7,54	OL-TF	F+FBL+W+L	49	6600	8,74	OL-OF	F+FBL+L	84	5140	8,12	OL-OF	F+FBL+L
15	4040	7,99	OL-TF	F+FBL+W+L	50	6100	8,71	OL-OF	F+FBL+L	85	6150	8,62	OL-OF	F+FBL+L
16	3750	7,48	TL-TF	F+FBL+W+L	51	6150	8,68	OL-OF	F+FBL+L	86	6050	8,51	OL-OF	F+FBL+L
17	4110	8,71	OL-TF	F+FBL+W+L	52	5300	8,61	OL-OF	F+FBL+L	87	5620	8,9	OL-OF	F+FBL+L
18	3180	8,34	TL-OF	F+FBL+W+L	53	6650	8,26	OL-OF	F+FBL+L	88	3885	8,18	TL-TF	F+L
19	3550	7,96	TL-TF	F+FBL+W+L	54	3930	7,46	TL-TF	F+FBL+W+L	89	3850	8,02	TL-TF	F+L
20	6080	8,99	OL-OF	F+FBL+W+L	55	3740	8,04	TL-TF	F+FBL+W+L	90	5220	8,51	OL-OF	F+FBL+W+L
21	6060	8,87	OL-OF	F+FBL+W+L	56	5960	7,98	OL-OF	F+FBL+L	91	5950	8,23	OL-OF	F+FBL+W+L
22	3450	8,74	TL-OF	T+L	57	5890	8,27	OL-OF	F+FBL+L	92	3770	7,38	OL-OF	F+FBL+W+L
23	3525	8,64	TL-OF	T+L	58	5190	8,99	OL-OF	F+FBL+L	93	3310	8,09	OL-TF	F+FBL+W+L
24	NA				59	6150	9,05	OL-OF	F+FBL+L	94	3590	8,07	OL-OF	F+FBL+W+L
25	NA				60	3460	8,15	TL-OF	F+L	95	3360	7,64	OL-OF	F+FBL+W+L
26	NA				61	3520	8,34	TL-OF	F+L	96	3180	7,83	OL-OF	F+FBL+W+L
27	NA				62	3260	7,94	TL-OF	F+L					
28	3930	8,12	TL-TF	F+FBL+L	63	3130	8,69	TL-OF	F+L					
29	3880	7,86	TL-TF	F+FBL+L	64	5170	8,24	OL-OF	F+FBL+L					
30	3770	7,44	OL-TF	F+FBL+W+L	65	6570	8,12	OL-OF	F+FBL+L					
31	3740	7,31	OL-TF	F+FBL+W+L	66	3380	7,53	TL-OF	F+FBL+W+L					
32	4030	7,26	TL-TF	F+FBL+W+L	67	3540	8,08	TL-OF	F+L					
33	3150	8,21	TF-OL	F+FBL+W+L	68	3640	7,97	TL-OF	F+FBL+W+L					
34	3150	8,21	TF-OL	F+FBL+W+L	69	3510	8,12	TL-OF	F+FBL+W+L					
35	3485	6,98	TF-OL	F+FBL+W+L	70	3325	8,35	TL-OF	F+FBL+W+L					

YEAR 2019 UP TO AUG 31

OBT WITH LEATHER COVER SITUATION

MIN % WEIGHT LOSS 6,98%
MAX % WEIGHT LOSS 9,49 %

TESTORI AERO SUPPLY FLAMMABILITY TEST RESULTS ANALYSIS (8/8)

In the table below are reported the loss weight percentages of the 2019 OBT tests performed until Aug. 31st and the range of the major population of results.

L-OBT		92	<7	7	7,2	7,4	7,6	7,8	8,0	8,2	8,4	8,6	8,8	9,0	9,2	9,4	9,6	9,8	
TL-TF		16																	16
	F+L	4							4										4
	F+FBL+L	3				1		1	1										3
	F+FBL+W+L	9			1	3		1	1	2									9
TL-OF		20																	20
	F+L	7						1	2	1		3							7
	F+FBL+L	0																	0
	F+FBL+W+L	13			1	2	2	1	2	3			1	1					13
OL-TF		12																	12
	F+L	2						1		1									2
	F+FBL+L	0																	0
	F+FBL+W+L	10	1		1	2		1	1	2		2							10
OL-OF		44																	44
	F+L	0																	0
	F+FBL+L	29						1	3	3	4	9	4	5					29
	F+FBL+W+L	15			1	1	1	2	1	3	1		3			2			15

TESTORI AERO SUPPLY FLAMMABILITY PROPOSAL

TAS, based on the previously described experience on OBT and based on the worldwide standardization of the industrial process of the chrome tanning, is very confident that the similarity criteria for flammability as per AC 25.853 can be applied to leather seat covers, maybe using, at least in the initial phase, a range of allowed similarity smaller if compared to the original leather seat cover.

TAS is proposing to repeat the experience of the last years based on a dedicated OBT test campaign that considers to use combinations of leather and foams from the most diffused TAS competitors using for each leather manufacturer 3 most common colours (Grey, Blue, Brown) and for each colour 3 variations such as light grey, medium grey and dark grey, plus 1 white and 1 black leather, for a total of 11 types of leather per manufacturer and combining them with the most common foams in terms of density and indentation, to demonstrate the possibility to apply the similarity criteria on leather seat covers and try to revise the AC 25.853.

This means, if we consider besides TAS additional 5 leather and 6 cushions manufacturers, a number of at least 11 x 6 x 7 = 462 OBTs as per the table in the next slide.

TESTORI
AERO SUPPLY

TESTORI AERO SUPPLY FLAMMABILITY PROPOSAL TEST MATRIX

	TAS	PERRONE	MUIRHEAD	LANTHAL	SPYNNIBECK	E-LEATHER
TAS	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
METZLER	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
GREINER	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
FRANKLIN	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
V&S	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
DAX	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
STARR	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample

TESTORI AERO SUPPLY SURROGATE CUSHION PROPOSAL (1/2)

TAS is willing to insert in this process an additional variant derived from AC 20-178 dtd. June 2012 and relevant to the criteria of the so called “Surrogate Panel”.

TAS, working on the retrofit and second life of the aircraft fields, is facing almost daily problems related to the possibility of retrieving the original seat cushions and the relevant foam OBT samples, especially on aged aircrafts.

Many times TAS has to wait months (and pay consistent amount of money) to receive the OBT specimen with consequent disappointment of the Customer and risk of loss of a business opportunity.

For this reason TAS has deeply analysed the problem and with the support of an Italian company manufacturing the foams for TAS has decided to propose the so called “Surrogate cushion”.

What does surrogate cushion mean?

In case there are no OBT test specimen available and/or it is not possible to even get the original specs of the cushion, TAS will be taking few original cushions from its customer, perform an analysis of the main characteristics of the cushion in terms of mechanical and chemical properties and through a process of reverse engineering perform the re-building of the cushions.

TESTORI
AERO SUPPLY

TESTORI AERO SUPPLY SURROGATE CUSHION PROPOSAL (2/2)

In this way TAS will basically double the previous table reaching a total of 858 OBTs.

	TAS	PERRONE	MUIRHEAD	LANTHAL	SPYNNIBECK	E-LEATHER
TAS	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
METZLER	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
Surr METZLER	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
GREINER	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
Surr. GREINER	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
FRANKLIN	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
Surr. FRANKLIN	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
V&S	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
Surr. V&S	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
DAX	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
Surr. DAX	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
STARR	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample
Sur. STARR	11 sample	11 sample	11 sample	11 sample	11 sample	11 sample

TESTORI
AERO SUPPLY

PRELIMINARY CONCLUSIONS

TAS will therefore perform additional 858 OBT in a reasonably short period (approx. 18-20 months) in order to run approx. 10 OBT per week with dedicated personnel into its Flammability Laboratory and achieve results very similar to the results of the previous approx. 1,000 performed in the last 10 years and finally **demonstrate the opportunity to apply the flammability similarity criteria to the leather seat cover and avoid to perform the OBT and/or at least validate the surrogate cushion reverse engineering method.**

The program is on going with following further steps…