

“ If it’s not Boeing, I’m not going? ”

Boeing 737 MAX Crash Cases from the EU Product Liability Directive Perspective

July 2019

ABSTRACT

For the past nine months, it was hard to open any newspapers or a web portal without seeing the name of probably world's best-known aircraft manufacturer in the headlines. Both preliminary reports, after crashes in October 2018 and March 2019, suggest that Angle of Attack sensors and software – the The Maneuvering Characteristics Augmentation System – caused, or at least played a serious role, in both incidents. This paper examines those two recent Boeing 738 MAX 8 tragedies in the light of the EU product liability law, focusing on the European Directive 85/374/EC and the definition of the term (defective) product.¹

¹ Title of the paper refers to some pilots' who preferred the American manufacturer, saying: "If it's not Boeing, I'm not going."

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INTRODUCTION

In 2018, airlines flew approximately 4.3 billion passengers on nearly 45 million flights worldwide. It is expected that 2019 will set a new record and according to the projections, by 2036 there will be 7,8 billion passengers.² The year 2018 also resulted in 15 accidents and 556 fatalities but, despite these sad statistics, air transport is still considered to be the safest mode of transportation.³

On 28 October 2018, Lion Air flight JT610, scheduled on a domestic route from Soekarno–Hatta International Airport in Jakarta to Depati Amir Airport in Pangkal Pinang, crashed into the Java sea only 13 minutes after the take-off, killing all 189 passengers and crew on board. The airline acquired new Boeing 737 MAX 8 aircraft in August 2018 and it had flown 895,21 hours.⁴

Only a few months later, on 10 March 2019, Ethiopian Airlines Flight ET302 crashed on international scheduled passengers flight from Addis Ababa Bole Int. Airport to Nairobi, Kenya Jomo Kenyatta Int. Airport. A Boeing's 737 MAX 8 nose dived into the ground 28 NM South East of Addis Ababa, after 6 minutes airborne, killing all 157 passengers and crew on board.⁵ The airline acquired the aircraft in November 2018 and it had flown 1330,3 hours.⁶

Both preliminary reports, as well as news reports and actions conducted by the Federal Aviation Administration (hereinafter: the FAA), other regulators, and Boeing, suggest that Angle of Attack sensors (hereinafter: the AOA sensors) and software – the The Maneuvering

² IATA annual review (June 2019).

³ See https://aviation-safety.net/graphics/infographics/ASN_infographic_2018.jpg - accessed 24 July 2019.

⁴ Preliminary Aircraft Accident Investigation Report, Komite Nasional Keselamatan Transportasi (KNKT.18.10.35.04 - 29 October 2018) 1-6.

⁵ Aircraft Accident Investigation Preliminary Report No. AI-01/19, Federal Democratic Republic of Ethiopia, Ministry of Transport, Aircraft Accident Investigation Bureau (March 2019) 3.

⁶ *Ibid.* – 14.

Characteristics Augmentation System (hereinafter: the MCAS) – caused or at least played a serious role in both incidents.⁷

After Lions Air crash, Boeing reacted with an update to the flight crew operations manual for its 737 MAX 8, warning of a possible fault in the aircraft's AOA system that could cause the aircraft to violently pitch nose down, and FAA followed with an emergency airworthiness directive demanding compliance from the operators in less than 30 days.⁸ After second incident on March 11, China, who operates the largest fleet of Boeing 737 Max aircraft was the first country who grounded them⁹, followed by majority aviation agencies and individual airlines in the next two days, including also EASA¹⁰ and finally FAA¹¹ after the Trump's initiative (after initially reaffirming the safety of the new aircrafts¹²).

At the time of writing this paper, all 387 Boeing 737 MAX 8 aircrafts are grounded, while numerous investigations¹³ and procedures¹⁴ are underway.

⁷ See

https://www.internationallawoffice.com/Newsletters/Aviation/USA/Cozen-OConnor/Reflections-on-Boeings-exposure-following-737-MAX-crashes?utm_source=ILO+Newsletter&utm_medium=email&utm_content=Newsletter+2019-05-08&utm_campaign=Aviation+Newsletter - accessed 24 July 2019.

⁸ FAA Emergency Airworthiness Directive 2018-23-51, 7 November 2018.

⁹ See <https://www.bbc.com/news/business-48362283> - accessed 24 July 2019.

¹⁰ Airworthiness Directive, No. 2019-0051R1, 25 March 2019 (Revision), Original issued 12 March 2019 <https://www.easa.europa.eu/newsroom-and-events/press-releases/easa-suspends-all-boeing-737-max-operations-europe> .

¹¹ See https://www.faa.gov/news/updates/media/Emergency_Order.pdf - accessed 24 July 2019.

¹² FAA-Continued Airworthiness Notification to the International Community from 11 March 2019.

¹³ E.g. U.S. House committee hearings, Department of Justice criminal investigation <https://www.seattletimes.com/business/boeing-aerospace/i-miss-them-father-who-lost-five-family-members-in-boeing-737-max-crash-tells-lawmakers/> - accessed 30 July 2019.

¹⁴ E.g. litigations stemming from two deadly crashes <https://www.reuters.com/article/us-ethiopia-airplane-boeing-litigation/us-judge-orders-boeing-to-turn-over-documents-in-737-max-crash-litigation-idUSKCN1TS2GT> - accessed 30 July 2019.

Pilot's class action suit

<https://www.aerotime.aero/ruta.burbaite/22788-more-than-400-pilots-of-737-max-are-suing-boeing-for-cover-up> - accessed 30 July 2019.

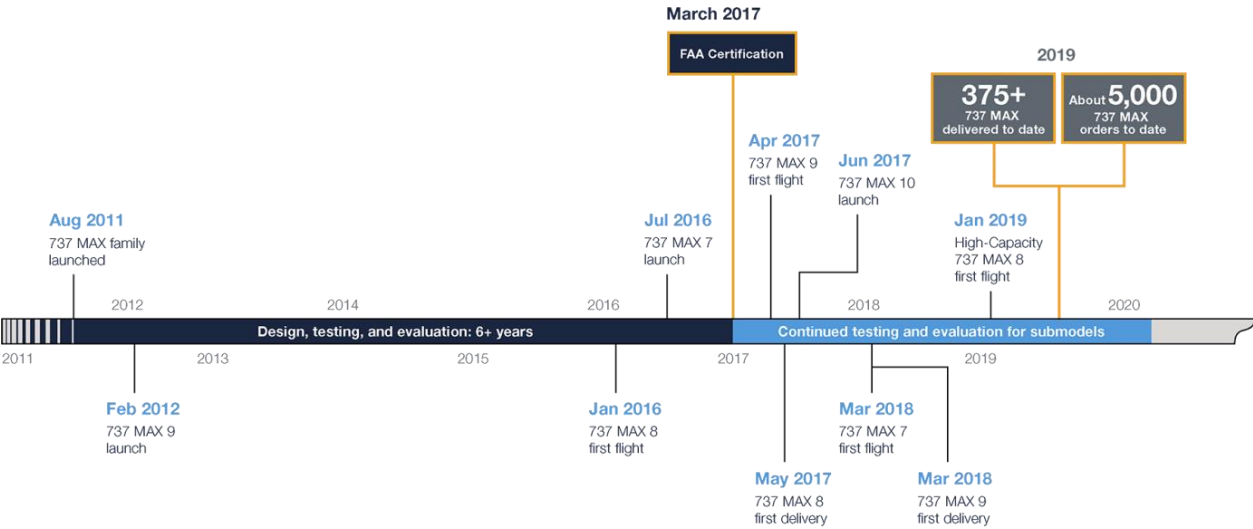
Airlines requiring compensation

<http://global.chinadaily.com.cn/a/201907/09/WS5d23f5ada3105895c2e7c6e4.html> - accessed 30 July 2019.

1. THE BOEING 737 MAX

1.1. Production timeline

In spring 2011, Boeing was unpleasantly surprised when they learned that American Airlines, their loyal and exclusive customer for more than a decade, was negotiating and ready to order hundreds of new fuel-efficient A320neo jets from Boeing’s European rival Airbus. In order to win the deal, instead of designing a new type of aircraft from scratch – which would probably take a decade – Boeing decided to take a shortcut and, to be blunt, mount new, bigger and fuel-efficient engines on old 373 aircraft frame. It was far quicker, easier and cheaper and only three months later, the fourth generation of the Boeing 737 planes – MAX family¹⁵ was born.



Picture 1 - 737 MAX Family Timeline¹⁶

¹⁵ As found in <https://www.boeing.com/commercial/737max/737max-legacy.page#/facts> - accessed 25 July 2019. The 737 MAX family includes the 737 MAX 7, 737 MAX 8, High-Capacity 737 MAX 8, 737 MAX 9 and 737 MAX 10.

¹⁶ *Ibid.*

Because Boeing was trotting behind Airbus who announced A320neo in 2010, engineers and designers were pushed to work at roughly double the normal pace. The instructions from the Company were clear - minimum change to avert a requirement that pilots need to spend time training in simulators, minimum change to reduce costs, and to get it done quickly.¹⁷

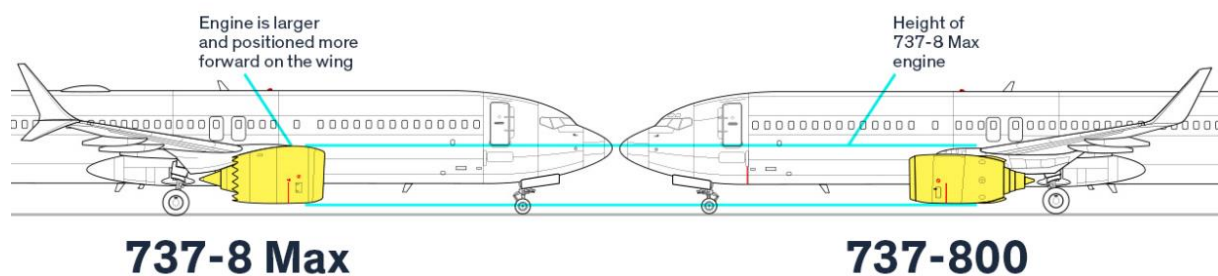
This “If it’s not broke, don’t fix it” business strategy, to keep updating the plane rather than designing a new type, offered competitive advantages and was a win-win for both airlines and Boeing. Pilots were already familiar and comfortable flying it, so there was no need for the airlines to invest in new training. For Boeing, it was faster and cheaper to redesign and recertify than starting a new - but the limits of 50 years old aircraft were being pushed, and now the plan backfired and left 346 mourning families and the company in a crisis never seen before.¹⁸

¹⁷ See <https://www.nytimes.com/2019/03/23/business/boeing-737-max-crash.html?module=inline> - accessed 24 July 2019.

¹⁸ See <https://www.nytimes.com/2019/04/08/business/boeing-737-max-.html> - accessed 24 July 2019.

1.2. Airframe and Aerodynamic problem

As a result of Boeings strategy, ground clearance became a problem because engineers needed to find a way to mount much bigger engines¹⁹ on the old airframe, so they had to move the mounting point of the engines more forward and farther up.



Picture 2 - Comparison of the engines²⁰

This solution led to an aerodynamic problem - change disrupted the plane's center of gravity and caused the MAX to have a tendency to elevate its nose upward during flight, increasing the possibility of a stall.²¹

¹⁹ See <https://www.businessinsider.com/boeing-737-max-design-pushed-to-limit-2019-3> - accessed 30 July 2019
There is a direct correlation between the diameter of a turbofan engine's fan blades and the amount of thrust the engine can produce. Generally speaking, the larger the fan diameter, the more powerful the engine .

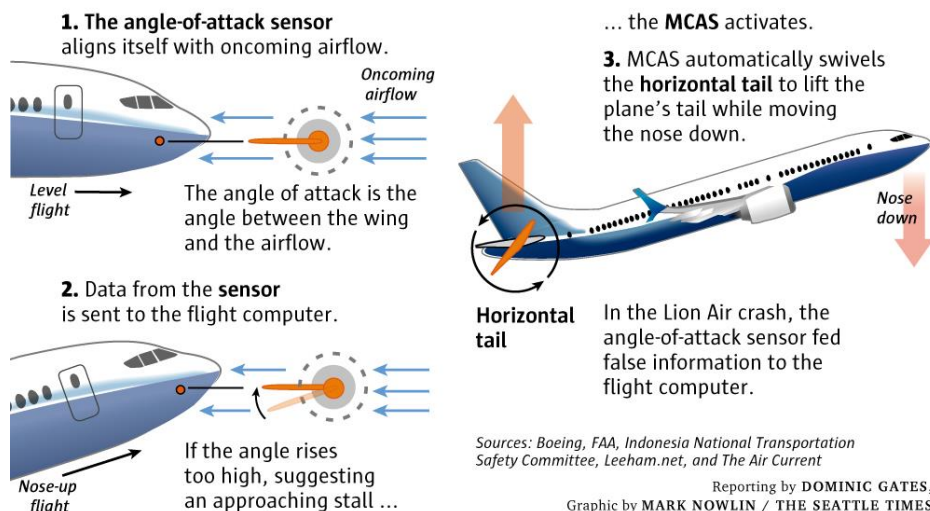
²⁰ See <https://spectrum.ieee.org/aerospace/aviation/how-the-boeing-737-max-disaster-looks-to-a-software-developer> - accessed 30 July 2019.

²¹ Jeppesen Sanderson Training Products - *Instrument Commercial Manual* (Canada, 2000.) 12-36
At any angle of attack beyond $C_{L_{max}}$, the air flow can no longer follow the upper surface of the wing and the flow separates. The wing loses lift, and the airplane accelerates downward because weight exceeds lift.

1.3. Systems engineering problem

Boeing's solution to its hardware - aerodynamic problem was a software. Boeing engineers created the MCAS,²² to automatically counteract this pointing up tendency and point the nose of the plane downward. Originally, MCAS was designed to activate only in limited circumstances²³, but after first test flight in January 2016, the Company decided to make some changes and they made the software more aggressive and dangerous.²⁴

How the MCAS (Maneuvering Characteristics Augmentation System) works on the 737 MAX



²² See <https://www.boeing.com/commercial/737max/737-max-contacts.page> - accessed 30 July 2019
MCAS is a flight control law implemented on the 737 MAX to improve aircraft handling characteristics and decrease pitch-up tendency at elevated angles of attack. It was designed and certified for the 737 MAX to enhance the pitch stability of the airplane, so that it feels and flies like other 737s.

²³ *Ibid.* - accessed 30 July 2019

when three conditions occur:

1. The airplane nose approaches a higher-than-usual angle
2. The pilot is manually flying up
3. The airplane flaps are up.

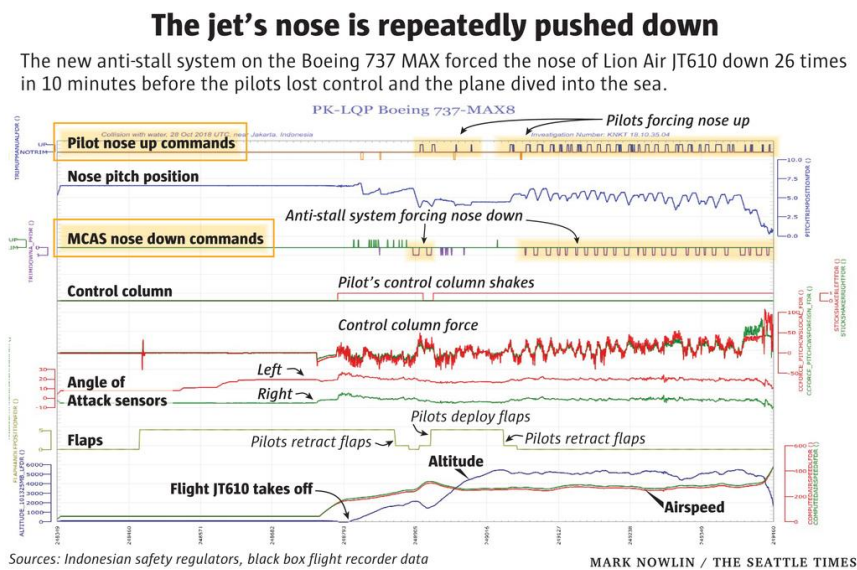
²⁴ See <https://www.nytimes.com/2019/06/01/business/boeing-737-max-crash.html?module=inline&login=google> - accessed 30 July 2019. The original version of MCAS could move the stabilizer, the part of the tail that controls the vertical direction of the jet, a maximum of about 0.6 degrees in about 10 seconds. The new version could move the stabilizer up to 2.5 degrees in 10 seconds. The FAA had already approved the previous version of MCAS and didn't require it to take a second look because the changes didn't affect how the plane operated in extreme situations.

Picture 4 - the MCAS²⁵

The MCAS software also had a major design defect being that it relied on the reading from a single sensor called the angle of attack vane,²⁶ even though the aircraft has two of them, one on each side of the fuselage near the cockpit.



Picture 3 - the position of AOA Sensors²⁷



Picture 5 - black box from Lion Air JT610 flight²⁸

²⁵ See

<https://www.seattletimes.com/business/boeing-aerospace/failed-certification-faa-missed-safety-issues-in-the-737-max-system-implicated-in-the-lion-air-crash/> - accessed 30 July 2019.

²⁶ *Op.id.* n 21, 12-4.

The angle of attack is the angle between the chord line of the wing and the relative wind.

²⁷ *Op.id.* n 22.

1.4. The aftermath of the crashes

Problems that have surfaced after crashes are numerous. From the questionable FAA certification process²⁹ and delegation a part of it back to the Boeing, quality of pilots training³⁰ and flight hours requirements³¹, maintenance of the aircraft³² etc., to problems primarily of a financial nature, that occurred for Boeing. According to the current information, Boeing is going to pay around \$5.6 billion of compensation to its MAX customers, on top of that, the production slowdown is going to cost a further \$1.7 billion. Boeing also recently established a \$100 million fund for families and communities affected by the two crashes.³³ These numbers do not include the potential outcomes of litigation.³⁴ Of course, there are all the cancelled flights and even cancelled routes³⁵ due to grounding of all MAX aircrafts all over the world, some of the airlines (e.g. Norwegian) are in serious financial problems,³⁶ and some of them (e.g. Ryanair) are scaling back from their growth plans.³⁷

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See

<https://www.seattletimes.com/business/boeing-aerospace/failed-certification-faa-missed-safety-issues-in-the-737-max-system-implicated-in-the-lion-air-crash/>- accessed 30 July 2019

Black box data from the Lion Air crash indicate that a single faulty sensor (a vane on the outside of the fuselage that measures the plane's "angle of attack," the angle between the airflow and the wing) triggered MCAS multiple times during the flight, initiating a battle between the system, as it repeatedly pushed the nose of the plane down, and the pilots who wrestled with the controls to pull it back up.

²⁹ See

<https://www.intelligent-aerospace.com/commercial/article/16537741/canceled-flights-swapped-planes-how-boeing-737-maxs-grounding-hits-airlines-and-passengers-as-summer-vacations-loom> - accessed 30 July 2019.

³⁰ See <https://www.nytimes.com/2019/07/17/opinion/boeing-737-max.html?searchResultPosition=1>
<https://edition.cnn.com/2019/06/26/politics/boeing-737-max-flaw/index.html>- accessed 30 July 2019.

³¹ See

<https://eu.usatoday.com/story/news/nation/2019/07/06/boeing-737-max-crash-grounded-problems-flight-training-pilots-faa/1641781001/> - accessed 30 July 2019.

³² See

<https://www.seattletimes.com/business/boeing-aerospace/black-box-data-reveals-lion-air-pilots-struggle-against-boeings-737-max-flight-control-system/>- accessed 30 July 2019.

³³ See <https://www.nytimes.com/2019/07/18/business/boeing-737-charge.html?searchResultPosition=2>- accessed 30 July 2019.

³⁴ See <https://www.bbc.com/news/business-48859463> - accessed 30 July 2019.

³⁵ See

<https://thepointsguy.com/news/southwest-airlines-suspends-13-routes-because-of-boeing-737-max-grounding/>- accessed 30 July 2019.

³⁶ See <https://simpleflying.com/norwegian-737-max-crisis/>- accessed 30 July 2019.

³⁷ See <https://www.nytimes.com/2019/07/16/business/boeing-737-max-ryanair.html?searchResultPosition=3>- accessed 30 July 2019.

2. PRODUCT LIABILITY

Product liability is any liability placed on the producer, distributor, importer, retailer or other supplier of products in respect of death or personal injury or property damage occasioned by the use of the product. Liability for products can be civil (based on contract, negligence, strict liability and absolute liability) or it can be imposed by the criminal law. The increase in product liability claims can be seen in the enhanced number over the last 130 years as a result of the innovations of the technical and scientific community, but also it has coincided with increased safety expectations of consumers.³⁸

2.1. Product liability in aviation

In aviation, when talking about liability, we first think of the air carrier's liability for the damage done to passengers³⁹ and their baggage.⁴⁰ On the other side, there is non-contractual liability for damage caused by a plane in flight to persons or property on the surface.

The existing international framework governing air carriers' liability for passengers' death and bodily injury can be very handy in cases where the damage was caused by the product (aircraft) deficiencies. First reason for that is that contractual liability of air carrier falls under international air law.⁴¹ This is a situation where product liability, as a part of civil law, comes forward. Firstly because of the safety of the passengers and responsibility of the manufacturer for placing a defective product on the market, and secondly for giving passengers an alternative in regards to compensation for damages. There are, at first sight, better chances for

³⁸ Geraint Howells, *Comparative product liability* (Dartmouth, 1993) p.1-2.

³⁹ For death, bodily injury and health damage, or cancelled flight, long delay and denied boarding.

⁴⁰ Or for cargo that is being shipped by aircraft (loss, damage and delay).

⁴¹ It is regulated under Convention for the Unification of Certain Rules Relating to International Carriage by Air (Warsaw Convention 1929) and Convention for the unification of certain rules for international carriage by air (Montreal Convention, 1999) - Article 21 of MC regulates liability of air carrier as 2 tier - strict liability up to 113,100 SDR and unlimited liability beyond (but subject to a range of defences).

the plaintiff to recover more damages from the more lucrative manufacturer than from air carrier.⁴²

2.2. Product liability in the European Union

Council Directive of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products (hereinafter: Directive 85/374)⁴³ governs product liability in the EU. It was the first EU legislation which touched the private law of the Member States.⁴⁴ The Directive sets the conditions under which consumers may claim compensation for the damage caused by defective products on the internal market and has three strategic objectives:

1. to ensure the free movement of goods,
2. to offer protection of consumers' health and property, and
3. to leave competition among market operators in the Single Market undistorted.⁴⁵

The Directive 85/374 has been substantially amended by Directive 1999/34/EC, which extended its scope to include agricultural and fishery products⁴⁶. Therefore, Directive 85/374 and the Directive 2001/95/EC,⁴⁷ are two primary and most important sources of EU legislation governing the product safety and liability in EU.

⁴² Sidhant Sharma, *Aviation Product Liability in the European Union* (The Aviation & Space Journal, Jan / Mar 2016 year XV N° 1) 2-3.

⁴³ Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products - *Official Journal L 210*, 07/08/1985 P. 0029 – 0033.

⁴⁴ Simon Whittaker, *Liability for Products* (Oxford, 2005), 1.

⁴⁵ Evaluation of Council Directive 85/374/EEC on the approximation of laws, regulations and administrative provisions of the Member States concerning liability for defective products - final report (January 2018) p. xi.

⁴⁶ Directive 1999/34/EC of the European Parliament and of the Council of 10 May 1999 amending Council Directive 85/374/EEC on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products -*Official Journal L 141*, 04/06/1999 P. 0020 – 0021.

⁴⁷ Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety (Text with EEA relevance) - *Official Journal L 011*, 15/01/2002 P. 0004 - 0017

Differently from regulations, according to EU law, directives are legislative acts that set out objectives that all EU Member States must achieve through their implementation. Therefore, directive is not a binding legislative act that must be applied directly and in its entirety in all Member States, but it is rather up to Member states to transpose particular directive into their national law and find a way to reach the goal of that directive, taking into consideration and adapting it to their own needs.⁴⁸ As a result of legal nature of Directive 85/374, product liability regime is not entirely same across all Member States and it may differ⁴⁹ a little bit.

2.3. Council Directive 85/374/EEC

Articles 1 and 4 of the Directive introduce the concept of strict liability of the producer and place the burden of proof upon the injured person. Therefore, the claimant needs to prove the damage, the defect and the causal relationship between them,⁵⁰ but there is no need to prove the breach of a standard of care that a reasonable person should exercise in a given situation to avoid causing injury (he doesn't have to prove the negligence or fault of the producer/importer),⁵¹ as it is required under many major common law jurisdictions.⁵²

Under the Directive 85/374 product is defined as all movables, even though incorporated into another movable or into an immovable,⁵³ including electricity. However, nuclear energy is expressly excluded from the Directive's scope.⁵⁴

⁴⁸ https://europa.eu/european-union/eu-law/legal-acts_en#directives - accessed 26 July 2019

⁴⁹ See n 45

⁵⁰ Directive 85/374/EEC - Article 4

⁵¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3A132012> - accessed 27 July 2019

⁵² *Op.cit.* n 42, 3

⁵³ Directive 85/374/EEC - Article 2

⁵⁴ Directive 85/374/EEC - Article 14

Producer means the manufacturer of a finished product, of a component part and any person who presents himself as a producer. Also, any person who imports a product for sale, hire, leasing or any form of distribution in the course of his business into the EU shall be responsible as a producer.⁵⁵

The Directive also provides the possibility of joint liability⁵⁶, and lists six reasons for the exoneration from the liability. The most important for the manufacturer is under Article 7(b) saying “that, having regard to the circumstances, it is probable that the defect which caused the damage did not exist at the time when the product was put into circulation by him or that this defect came into being afterwards”. For the manufacturer of a component, the most important exoneration reason lies under Article 7(f) providing “that the defect is attributable to the design of the product in which the component has been fitted or to the instructions given by the manufacturer of the product”.⁵⁷

Furthermore, the liability of the producer shall not be reduced when the damage is caused both by a defect in the product and by the act or omission of a third party, but it may be reduced or disallowed when the damage is caused both by a defect in the product and by the fault of the injured person or any person for whom the injured person is responsible.⁵⁸

The meaning and scope of the term “damage” under this Directive relate to:

- (a) damage caused by death or by personal injuries, and
- (b) damage or destruction of any item of property other than the defective product itself, with a lower threshold of 500 Euros, if the item of property:
 - is ordinarily intended for private use or consumption, and that
 - was used by the injured person mainly for his own private use or consumption.

⁵⁵ Directive 85/374/EEC - Article 3

⁵⁶ Directive 85/374/EEC - Article 5

⁵⁷ Directive 85/374/EEC - Article 7

⁵⁸ Directive 85/374/EEC - Article 8

The 500 Euros threshold applies only to damage/destruction of property and it prevents claimants from obtaining compensation in case of lower damages, but it doesn't apply in case of death and physical injuries. When talking about non-material damage, the Directive does not contain more detailed provisions but rather refers to national law.⁵⁹

The statute of limitation imposed by Directive is of three years and it begins from the day on which the plaintiff became aware, or should reasonably have become aware, of the damage, the defect and the identity of the producer (subjective deadline),⁶⁰ but not after the expiry of a period of ten years from the date on which the producer put into circulation the actual product which caused the damage unless the injured person has in the meantime brought an action against the manufacturer (objective deadline).⁶¹

Pursuant to Article 13, the Directive does not affect or exclude other rights that an injured person may have under existing national laws that were in place at the time Directive was adopted. Hence, the Directive is meant to operate alongside national laws of the Member States relating to product liability, based on e.g. contract and/or tort,⁶² and leaves the possibility of a co-existence of product liability systems open.⁶³

As it is often the case in directives, Article 15 provides the possibility of derogation in some cases (Article 2 and 7) as well as the possibility for Member States, in addition to the €500 threshold, to limit producer's total liability for damage resulting from a death or personal injury caused by the same defect to not less than 70 million Euros⁶⁴.

⁵⁹ Directive 85/374/EEC - Article 9.

⁶⁰ Directive 85/374/EEC- Article 10.

⁶¹ Directive 85/374/EEC - Article 11.

⁶² *Loc.cit.* n 45.

⁶³ Duncan Fairgrieve, editor - *Product liability in comparative perspective* (Cambridge, 2005).

⁶⁴ Directive 85/374/EEC - Article 16

2.4. Implementation of the Directive and it's relevance in national product liability laws

As mentioned earlier, the product liability regime may differ from Member State to Member State as a result of implementation in their respective national laws.

Article 21 of Directive 85/374 stipulates that every five years the Commission is going to present a report to the Council on the application of the Directive and, if necessary, submit appropriate proposals to it. Therefore, in January 2018 Commission published the final report on the evaluation of the Directive 85/374/EEC (hereinafter: the EU Report).⁶⁵

According to the EU Report all 28 Member States have transposed the Directive into their legislation. Five Member States have adopted the derogation under Article 15 of the Directive, however, the derogation has not been transposed uniformly across them. Two Member States have adopted it without limitations, thereby applying it to all categories of producers and products, and the other three excluding some categories of producers and products⁶⁶. When transposing the Directive, all Member States except seven of them have introduced some provisions to clarify certain concepts of the Directive: i.e. a criteria to determine when a product is “put into circulation”, the “reasonable time” by which the injured person has to be informed of the identity of the producer/supplier, some specified the nature of damages that can be indemnified etc.⁶⁷

The EU Report concludes that the Directive is effective in guaranteeing producers' liability and a well-functioning internal market for goods, but it did not conclude the effectiveness of the Directive vis-à-vis new technological developments.⁶⁸

⁶⁵ Alongside public consultation, the European Commission also carried out a targeted survey and face-to-face interviews with different categories of stakeholder (e.g. producers, industrial associations, consumer associations, insurers, public authorities, law firms, consultancy firms and academics. - loc.cit. n21.

⁶⁶ Spain, Finland, France, Hungary, Luxembourg,

⁶⁷ *Op.cit.* n 44, 16.

⁶⁸ *Op.cit.* n 44, ix.

When it comes to efficiency, the Directive is a private law instrument which leaves to the parties (i.e. Member States) the burden of enforcement. Therefore, the length of the procedures differs from Member State to Member State and the main costs (e.g. court fees, lawyers and experts fees, that vary considerably across Member States⁶⁹) can fall in the end on either the consumer or producer - depending on the outcome of the proceedings.⁷⁰

The EU Report concludes that the Directive is coherent with EU rules on consumer protection in the area of contractual liability, the ‘digital contracts proposals’, the EU product safety policies as well as EU rules on applicable law.⁷¹

Overall, according to the EU Report, the Directive still seems to be relevant to the initial needs seeing that the number of claims as well as the average EU litigation rate regarding the defective products has not fallen in recent years.⁷² That relevance is less straightforward when considering new technological developments. In that regard, the most challenged are the definitions of product, damage, defect, and the list of exemptions of liability in favour of the producer, such as the development risk clause. Ergo, it might be smart, sooner rather than later, to reconsider amendment of the Directive than relying to the means of the interpretation only. Furthermore, some of the key elements of a product liability action are left to domestic law (e.g. areas of causation, remoteness of damage, standard of proof, contributory acts, procedure and rules of discovery etc.) which disrupts the process of harmonization of product liability law across Member States.⁷³

⁶⁹ Average cost for legal assistance could range from €75 to over €3,000, and costs for civil proceedings between less than €200 to over €2,000.

⁷⁰ *Op.cit.* n 44, xiii.

⁷¹ *Op.cit.* n 44, xv.

⁷² *Op.cit.* n 44, xvi.

⁷³ *Op.cit.* n 62, 3.

3. Analysis of Directive 85/374 and its applicability to aviation cases

All in all, as seen above, Directive 85/374 partially managed to uniform consumer protection and harmonise product liability rules all over the EU, which the Member States could not achieve by themselves, and has reached a reasonable uniformity in its implementation. Having that in mind, it is necessary to analyse some of the key concepts of the Directive and their applicability to aviation.

3.1. Definition of defective product and the expectation of safety standard

Definition of a defective product in Article 6 depends on the expectation of safety of the entitled person. This definition is connected to the strict liability standard laid down in Article 1. Generally there are at least two formulations of the strict liability standard. One is based on the risk-utility test⁷⁴, and the other on the test of consumer expectations. When talking about strict liability opposed to the fault, the two most important differing factors are that liability is based on the objective nature of the product rather than on the behaviour of the producer, and that the producer is imputed with the knowledge of the risks of the product, albeit he did not and (he) could not have known of them when he marketed the product. On one side, criticism around the expectation standards is concerned with the psychological ability and limitations of the consumer to even roughly estimate what level of safety he can expect, especially if he is not provided with the information necessary to form accurate expectation, moreover if the product falls into the modern and complex technology category, about which the general population has limited or non-existent knowledge. On the other hand, there is danger of industries setting their own standards via marketing and advertising, especially nowadays through social media, and in that manner influencing consumer expectations.⁷⁵ Since

⁷⁴ The risk utility test essentially balances the foreseeable risk of harm of the product, which could be reduced or avoided by adopting a reasonable alternative design and, failing to adopt such a design, "renders the product not reasonably safe"(...) As found in https://www.internationallawoffice.com/Newsletters/Aviation/USA/Cozen-OConnor/Reflections-on-Boeings-exposure-following-737-MAX-crashes?utm_source=ILO+Newsletter&utm_medium=email&utm_content=Newsletter+2019-05-08&utm_campaign=Aviation+Newsletter#Civil%20liability - accessed 30 July 2019.

⁷⁵ *Op.cit.* n 38, 7-13, 35-36.

expectation is a very subjective criteria, this wording in Directive could be a source of uncertainty in its application. The EU Report concludes that criteria is in fact objective because the defectiveness must lay on the basis of the legitimate expectations of the public (what normal prudent persons would expect) and thus not on the subjective expectations of an individual.⁷⁶

3.2. Definition of damage

Definition in Article 9 specifies damage as damage caused by death or by personal injuries, as well as damage/destruction of any item of property intended for private use. While the term death is pretty clear, the Directive doesn't offer further explanation of term „personal injury“. Therefore, the question is if it covers only physical injury, or if it includes psychological injury (damage) accompanied by physical injuries and/or maybe psychological injury alone? Since MC1999 provides compensation in cases of psychological injury only if caused or accompanied by physical injury, as it is established in case law,⁷⁷ this kind of interpretation of personal injury could offer claimants an alternative to bring a claim for this type damages other than under MC 1999. This solution could be very beneficial in product liability cases arising from airplane crashes (provided that the other conditions are met) since claimants are often affected with the Posttraumatic Stress Disorder. But there is another problem which goes along with the previous inconsistency of interpretation, that lies under the last subparagraph of the same Article which states that the Directive leaves the matter of non-material damages in hands of the Member States. That kind of solution is likely to lead to uncertainty and rather different amounts of damages in different Member States for the same cases or, in the worst case, no damages at all because the national legislation doesn't provide for them. The lack of harmonization around the question of the type and amount of recoverable damages jeopardizes the attempts of harmonization and prevention of the need for forum shopping.⁷⁸

⁷⁶ *Op.cit.* n 44, 84.

⁷⁷ *Eastern Airlines, Inc. v. Floyd*, 499 U.S. 530 (1991).

El Al Israel Airlines, Ltd. v. Tsui Yuan Tseng, 525 U.S. 155 (1999).

⁷⁸ *Op.cit.* n 38, 45.

3.3. Definition of a producer

Article 3 of the Directive holds responsible as a producer any person who imports into the EU a product for sale, hire, leasing or any form of distribution in the course of his business. In a situation where the EU carrier, e.g. Lufthansa, buys an aircraft from a non EU manufacturer e.g. Boeing, , and sells or leases it to another air carrier, and then is found liable as a producer under the Directive, there is a question whether the national court should continue applying Directive 85/374 or it should apply MC 1999. This issue arises due to the fact that a producer is an air carrier to whom the liability relates, and especially taking into consideration the exclusivity principle of the MC as stated in Article 29 of the Convention.⁷⁹

3.4. Definition of a product

Finally, the most important definition in light of this paper's topic, is the one of the product. Article 2 of the Directive defines product as all movables, even though incorporated into another movable or into an immovable (e.g. building materials such as cement integrated in the house), but does not extend to immovables. According to this definition, the interpretation of the term product means, even though it's not expressly established, that only physical, movable goods should be considered as products. This definition was good enough at the time when the Directive was adopted. Therefore, even if we manage to squeeze through some of the new technical developments under this – outdated –definition of a product, e.g. if we consider software as an integral part of an aircraft, it still leaves us in a gray area of uncertainty that is not suitable for the society we live in today.⁸⁰

⁷⁹ *Op.cit.* n 42, 7.

⁸⁰ *Op.cit.* n 44, 75.

3.5. Is software a product under Directive 85/374?

The EU Report shows that even in Member States' national jurisdictions there is no specific legislation concerning the product liability for new technological developments, such as software, robots, artificial intelligence or 3D printing. As a result of their specificities and peculiarities, applicability of the Directive to these technologies is not straightforward. Those specificities and peculiarities include, to name a few, the complexity of some IT products that combine both product and service (services are not defined nor covered by Directive, e.g. cloud technologies), the interconnectedness of automated systems, the increasing autonomy and learning capacity involved in artificial intelligence, autonomous vehicles and robots, the blurriness of the distinction between producers and consumers due to the sharing economy as well as to the 3D printers, the difficulty in differentiation between private and professional use of a product, the concerns about privacy and cybersecurity etc.⁸¹

In recent Boeing MAX crashes, although investigations are not yet completed and causes of accidents cannot be determined with certainty, preliminary reports in both Lion Air and Ethiopian Air cases strongly suggest that the faulty AOA sensors that fed the MCAS software with the erroneous information were the probable cause of the accidents.

So if faulty software causes a plane to crash, the question is if the software, as a immovable, should be considered as a component, an integral part of the plane and as a product within the definition in Article 2?⁸² On the other hand, the fact that in Lions Air crash there were no instructions in regards to the MCAS in pilot's flying manual and what's even more appalling, the pilots didn't even know the MCAS existed and was working the whole time in the background. Apparently it is up to national courts and the Court of Justice of the EU to offer clarification through case law in this type of situations. Nevertheless these accidents should be

⁸¹ *Op.cit.* n 44, 64.

⁸² *Op.cit.* n 38, 34.

warning signs and at the same time food for thought for the Commission to speed up and make up their mind when it comes to the amendment of the Directive 85/374, so that for once legislation is not ten steps behind technology and we are not reacting ex-post factum.

3.5. Clarification of the term presentation

In light of the Boeing 737 MAX accidents, we should discuss the term of presentation of the product in Article 6, par. I of the Directive 85/374 that explains what circumstances are taken into the consideration when defining a defective product and claimants expectations towards the safety of the said product. That term could be widely interpreted, as it covers everything from packaging and containers, literature and manuals, the way the product is displayed, promotional material and advertisements for the product. The presentation could raise or lower consumer safety expectations, latter being the rarer, almost non-existent case. Typically advertising and marketing practices are stressing the advantages of the product and promoting confidence in it, so was the case with Boing and the fourth generation of 737.⁸³ The Company didn't say a word to the pilots about MCAS or the reason why it was developed, they didn't mention it in pilot's flight manual nor did they provide the procedure and checklist for overriding the software in case of failure⁸⁴. What is even worse, the Company tried really hard⁸⁵ to reduce the manufacturing and certificating costs and to eliminate the additional cost for the air carriers relating pilots training on the simulators, leaving pilots and hundreds of people for whose lives they are accountable for in the dark. We are here once again returning to the problem of expectations standards, or rather the inability of creating it due to the lack of information.

⁸³ See <https://www.boeing.com/commercial/737max/> - accessed 28 July 2019

⁸⁴ Management at Southwest Airlines told its pilots that Boeing did not include any description of MCAS in the flight manual because a pilot "should never see the operation of MCAS" in normal flying. <https://www.seattletimes.com/business/boeing-aerospace/faa-evaluates-a-potential-design-flaw-on-boeings-737-max-after-lion-air-crash/> - accessed 30 July 2019.

⁸⁵ See <https://www.nytimes.com/2019/03/23/business/boeing-737-max-crash.html?module=inline> - accessed 30 July 2019.

3.6. Exonerating reasons

When observing the exonerating reasons in Article 7 of Directive 85/374, the last one under the subparagraph (f), concerning the liability of the manufacturer of the component is of importance. There is a specific defence where the defect arose because of the misuse of the component by the end producer, or more importantly, like in Boeing cases, where the defect is due to the design of the product into which the component is fitted or where the defect is due to the faulty manufacturer's instructions. In the latter case, the manufacturer's instructions must have been very clear and detailed which left the component manufacturer with no margin of manoeuvre so that he can exercise his judgement and avoid making a defective product.⁸⁶ This scenario could be important in cases when aircraft manufacturer outsourced the design of software to its subcontractors but provided them with detailed instructions which strongly resembles the recent events. Indeed, Boeing, at the time when MCAS was developed, was laying off experienced in house engineers to cut costs and relied on Indian engineers making as little as US\$9 an hour to develop and test software⁸⁷. Related or just a coincidence, in recent years, Boeing has won several orders for Indian military and commercial carriers, such as a \$22 billion one in January 2017 to supply SpiceJet Ltd. which included 100 737MAX8 and represented Boeing's largest order ever from India, a country dominated by Airbus.⁸⁸

⁸⁶ *Op.cit.* n 38, 43.

⁸⁷ See <https://www.straitstimes.com/business/companies-markets/boeings-737-max-software-outsourced-to-lower-paid-contractors-former> - accessed 28 July 2019.

⁸⁸ See <https://economictimes.indiatimes.com/industry/transportation/airlines/-aviation/boeings-737-max-software-outsourced-to-rs-620-an-hour-indian-engineers/articleshow/69999513.cms?from=mdr> - accessed 28 July 2019.

CONCLUSION

This paper has analysed recent Boeing MAX crashes in Indonesia and Ethiopia, the timeline of events and consequences of those accidents. Even though all of the investigations and the proceedings are taking place in the US, this paper examines tragedies in the light of the EU product liability law, focusing on the European Directive 85/374/EC terms and main principles, and their applicability to aviation cases. The conclusion is that, while the Directive is still relevant, it would be smart to reconsider amending the Directive and some of the key elements of a product liability action that are left to domestic law, to enhance the process of harmonization of product liability law across the Member States. It would also be advisable to update Directive according to the time that we live in. These tragic accidents should be warning signs for the Commission to speed up the work when it comes to the amendment of the Directive 85/374, so that we are not left in the dark if tragedies like this happen in the EU.

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