Aircraft Certification Service Considerations for Addressing Shortfalls

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The purpose of this white paper is to identify key areas for improvement to address the serious breakdown of the US Airplane Certification, foreign airplane bilateral certification, continued operational safety, exemption, and rulemaking systems in the FAA. Safety engineers in the Aircraft Certification Service (AIR) have serious concerns about the weakened FAA safety culture and political climate that is putting self-interest ahead of safety. These concerns were expressed to senior FAA managers in the Aircraft Certification Service following the grounding of the 787[1], and again in a report in 2017[2]. Safety engineers also pushed to get the Safety Reporting Process (SRP) implemented in the Aircraft Certification Service (AIR) due to local decisions by managers that were not in the public interest. Unfortunately, while FAA management negotiated a memorandum of agreement with labor unions for formation of the SRP, it did not address the reported safety concerns submitted by employees or the shortfalls in the delegation system that led to the grounding of the 787 and 737 MAX MCAS accidents. For example, the rudder cable issue on the 737 MAX – which elicited concerns shared by about a dozen career safety engineers and managers at FAA – was never addressed.

Without a robust safety culture, US aviation products will not be successful and this will lead to loss of world leadership in aviation and drastic impacts on the US economy[3]. The groundings of the 787 and 737 Max clearly demonstrate the negative potential. We now have an opportunity to fix the broken system.

The function of the FAA is to provide oversight and world leadership over the air transportation safety network. This includes:

- Making findings of compliance to safety regulations at the time of certification of the airplane;
- Airplane manufacturing oversight
- Airline Oversight
- identifying unsafe conditions and corrective actions needed to address in-service safety issues that result in mandatory corrective actions and issuance of airworthiness directives (ADs), and

[1] Safety Engineers met with [redacted] in Washington DC following the grounding of the 787 to express our concerns over the broken oversight and Delegation system. (Powerpoint presentation included in the PDI report)

[2] PreDecisional Involvement Report and Transmittal Letter signed by 3 Unions sent to [redacted] expressing serious concerns with flawed delegation system and requesting changes.

[3] Aviation products are the number one US export and account for 5.4 percent of GDP.

- developing new regulatory safety standards in order to improve the safety of new and evolving technology products.

Broken Safety Net Puts Public and Industry at Risk

To understand what changes are needed in the current US aviation system we need to understand the cause of the failures that got us here. The FAA's predecessor [4]was originally formed when early airplanes built by for profit companies had high accident rates and banks would not loan money to this high risk industry. Regulatory oversight established minimum safety standards, improved safety, and public confidence in flying. Boeing CEO [redacted] stated in recent Congressional hearings that the survival of Boeing requires safety as a fundamental principle of their business model. Unfortunately, actions taken by the company were counter to this stated fundamental basis of their business model.

Capitalism works due to the incentives and rewards that influence human behavior. As Gordon Gekko says in the movie *Wall Street* "greed is good." However, the system only works if there are boundaries in place to prevent personal gain from damaging society. While we commonly hear statements from FAA managers that "industry is responsible for safety" and "companies would never cut safety corners because they do not want to risk their companies," we have seen failure after failure of successful companies when greed was left unchecked: Volkswagen, General Motors, British Petroleum, Boeing …

The fundamental concept of allowing a for-profit company to regulate itself is flawed.[5] The 737 Max certification is a prime example of how Boeing incentivized its management to improve profit margins and increase the stock price. As stated in the House Testimony, Boeing contracted to provide airplanes to Southwest Airlines without training. The penalty for any training was 280 million for the Southwest contract alone. This action preempted any ability of the engineers and pilots to require training or design changes needed to meet safety regulations. Everyone in the company was incentivized to meet schedules and optimize company profits:

1) from the managers in charge of deciding if a new modern cockpit that complied with new safety standards in Section 25.1322 should be incorporated,[6]
2) to the chief pilot in charge of training who said he would use "Jedi" powers to influence foreign authorities to accept eliminating MCAS training,

[4] The predecessor to the FAA was the CAA. The FAA was established in 1958 after the Grand Canyon mid-air collision.

[5] The ODA process being implemented due to the 2018 reauthorization language mandates that the FAA will delegate compliance to the Boeing ODA unless the FAA can prove a need to retain a compliance finding.

[6] Section 21.101, "Changed Product Rule" would have required compliance with section 25.1322, resulting in an updated cockpit design that would not allow misleading information. Boeing requested an exception by stating there had only been 3 hull loss fatal accidents on the 737 NG where flight deck interface was a contributing factor.

3) to the managers in charge of designing the MCAS system without including flight deck indication of failures activating MCAS
4) to refusing to comply with Section 25.903 and address catastrophic failure due to rudder control system damage,
5) to those rushing the certification process and not informing FAA engineers of a change to increase the authority of MCAS by a factor of 4,
6) to managers failing to inform the FAA of a software error that resulted in loss of the angle of attack disagree indication,
7) to failing to properly validate the procedures given to the FAA as an interim AD action after the Lion Air Crash,
8) to blaming the pilots after the accident
9) to lobbying Congress to expand delegation

In addition, Boeing has also refused to make design changes when deficiencies and non-compliances were identified by FAA safety engineers prior to type design approval. Boeing also has not been required by the FAA to bring the airplane into compliance when non-compliances are discovered following initial certification. Boeing is essentially rewarded for not developing a compliant design.

The incentives top to bottom in Boeing fostered a culture that eliminated layers of protection you typically would see in a robust safety culture. Changes in the Boeing safety culture are needed but this is an internal Boeing responsibility[7] in which the FAA and Congress can only facilitate by enacting a robust compliance system. Just as the original airplane manufacturers struggled to be successful without oversight and regulatory compliance, Boeing and other for profit companies require an effective governmental safety oversight system if they are going to continue to be successful.

FAILED FAA OVERSIGHT and SAFETY CULTURE

The ODA oversight process in place during the MAX certification allowed the FAA to retain any item and provide significant oversight (the 2018 reauthorization language[8] had not been adopted).

The FAA had the authority to:

1. Force Boeing to meet later certification standards for the cockpit/human factors so that false and misleading information would not be presented to the flight crew[9],

[7] Legislation mandating changes to the corporate governance system such as placing union representatives on the board of directors, eliminating incentives that conflict with a safety culture, are likely to be viewed as "socialist" concepts and unlikely to get political traction.

[8] The reauthorization language severely restricts FAA's ability to do effective oversight. It requires the FAA to delegate findings to the ODA for which they have been authorized unless the agency can prove retention is needed.

2. Retain direct review and approval of MCAS by safety engineers,
3. Mandate flight crew training,
4. Force Boeing to make design changes to achieve compliance with numerous regulations.
5. Take action against the ODA when deficiencies such as undue pressure of ARs and supervision records submitted to the BASOO, were reported, (there are other deficiencies that were not pursued).

Instead of using its oversight authority, the FAA relied on a flawed ODA concept and allowed Boeing to cut corners and eliminate layers of protection, violating the fundamental "fail safe" concept of aviation safety. How did the FAA system miss all of these critical errors? The answer is tied to changes in the safety culture due to the unprecedented safety achieved over the last decade since delegation was expanded during the early development of the 787. Instead of focusing on safety, the FAA incentivized all of their managers to "help industry get their products to market quickly" by removing regulatory oversight, such as removing safety engineers from the "critical certification path"[10]. Current senior executives in AVS and AIR came from industry[11] and have further promoted the current safety culture that has turned regulatory oversight over to the industry. [12]Unfortunately the negative impact of the FAA safety culture is not limited to just the ODA.

FAA managers are selected and rewarded based upon a demonstrated willingness to promote industry positions[13]. FAA managers have instilled a culture that undermines safety,

- they routinely overrule technical specialists, support issuance of type certificates with known non compliances,
- grant exemptions to safety requirements that are not in the public interest[14],
- allow production of airplanes with known non-compliances,
- do not take enforcement action when deficiencies in ODAs are found,
- do not reward or encourage employees to identify and fix safety problems,
- do not allow application of issue papers to address known safety problems,

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[9] The G-1 issue paper that established the cert basis of the MAX included arguments by Boeing that it was impractical to comply with updated cockpit safety standards, even though 3 hull loss fatal accidents were identified in the justification where flight crew indications were a contributing cause of the accidents.

[10] This objective was expressed by Senior FAA managers and is discussed in the Pre Decisional Involvement report

[11] See appendix 1

[12] [redacted] and [redacted] have pushed to complete eliminating the Airplane Directorate System, expanded delegation, converting Part 25 Safety regulations developed over 50 years of lessons learned to "consensus industry standards."

[13] According to a reliable source, SES bonuses include incentives based upon meeting industry schedules and needs. Promotions and awards are routinely provided to managers who demonstrate support of applicants over safety engineers and compliance.

[14] See 767 Fuel Quantity Indication System exemptions with 2 extensions. (Non-concurrence available upon request)

- and enter into bilateral agreements that remove FAA safety engineers from certification of foreign products.

Past and more recent events have shown a breakdown in the FAA safety net in rulemaking, certification and continued airworthiness. Examples of some more publicized issues include the fatal Southwest Airlines engine fan blade failure[15], the grounding of the 787 due to failed certification of the lithium-ion battery installation, recent grounding of 787 airplanes by airlines due to Rolls Royce Engine Compressor failures[16], inability of Airbus to deliver airplanes equipped with Pratt and Whitney geared fan engines due to a multitude of flaws in the FAA approved engine, and now the fatal 737 MAX accidents caused by flawed MCAS certification.

The FAA has lost our world leadership role in aviation due to a safety culture now driven by political forces that take the side of industry rather than the high ground of demonstrating to the world that public safety is our number one priority. The recent reaction to the 737 accidents by FAA management was a clear indication that keeping the 737 in the air was more important than demonstrating to the world our focus on safety. While airlines and foreign regulatory authorities around the world grounded the 737 Max, the FAA issued statements keeping the airplanes in operation saying they did not have data[17]. This stance contrasts with FAA actions in 1979 when the DC-10 was grounded until the cause of a fatal accident in Chicago following the engine detaching from the airplane was determined. The airplane was ungrounded after the cause of the accident was known and we knew the airplane was safe to carry passengers.

The FAA safety culture within Aircraft Certification resulted in the creation of an organizational structure with less than 45 employees doing oversight of Boeing. This organization, the Boeing Aviation Safety Oversight Office (BASOO) was implemented intentionally by FAA managers to remove the FAA safety engineers in the Seattle Airplane Certification Office (SACO) from the "Critical Path" of certification. Current head of Aviation Safety, [redacted] viewed engineers in the SACO as overly conservative and he also wanted to make sure Boeing got expedited service. The FAA has over 44,000 employees, yet the FAA management set up an organizational structure that did not have enough resources to have safety engineers evaluate the assumptions and type design of a brand new flight control feature on an airplane model that would carry the majority of the US travelling public for the next 30 years. The manager in charge of the section in the Boeing Aviation Safety Oversight Office told the DOT IG that the

[15] The FAA had not issued an AD mandating fan blade inspections 19 months after the prior event. EASA had issued their AD. The FAA also did not force Boeing to fix the non-compliant, flawed engine inlet design that the NTSB is now recommending be fixed.

[16] https://www.independent.co.uk/travel/news-and-advice/air-new-zealand-christmas-flight-cancelled-rolls-royce-engine-boeing-787-a9206681.html, https://asianaviation.com/reports-emirates-chief-slams-boeing-airbus/

[17] This statement was not true. The Seattle Airplane Certification Office (SACO) had conducted analysis showing the airplane should have been grounded and the acting SACO manager, [redacted] sent this information to Senior FAA management in Washington DC. Engineers in the SACO were asking why the airplane had not been grounded. It appears the decision to keep the airplanes flying was made by [redacted] and based upon support of Boeing, not safety.

reason the MCAS was delegated to Boeing was limited resources and a tight certification schedule.

Dan Elwell testified that for the FAA to take over oversight it would take 10,000 engineers and 1.8 Billion dollars. This testimony is inconsistent with the historical record. The FAA retained oversight and certified the highly successful Boeing 757, 767, 777 and 747-400 with Seattle Aircraft Certification Office staffing levels lower than the current staffing in the SACO, not counting the added BASOO staffing and numerous other staffing increases within AIR[18]. FAA managers have made numerous statements that the workload is increasing and therefore we need to delegate more. This assertion made directly to Congress is not supported by fact.[19] Rather than the FAA requesting additional budget from Congress to retain oversight capabilities, FAA managers made the argument oversight responsibilities should be given to the manufacturers. At the same time they increased staffing in other areas of AIR.

Comparison of DER and ODA system:

The DER oversight system used for the 747 through 777 models was based upon individual accountability and a local risk based delegation done directly by the safety engineers. Boeing would submit a letter to the FAA recommending a candidate as a DER in training. FAA safety engineers and managers would oversee the candidate to evaluate regulatory proficiency, technical competence, and ethical behavior before the candidate was given DER authority to recommend or approve certification documents. The amount of authority varied based upon the FAA safety engineers' evaluation of the capabilities of the individual DER. The DERs had open lines of direct communication to the FAA safety engineers so safety and compliance issues were immediately transparent to the FAA. The current system is based upon the assumption that the organization within the company can effectively operate as an independent branch within the company that will force the company to comply with regulations. The ODA selects Authorized Representatives (ARs), determines proficiency/competency, regardless of turnover in the organization and organizational pressures within the company to meet certification schedules. In addition, the Boeing ODA has a group review of specific issues that has resulted in many ARs not wanting to speak up due to a "group think" phenomenon. The fundamental assumptions that form the basis of the ODA are flawed. Boeing hiring practices have diluted technical

[18] AIR created the BASOO and new organizations such as AIR 300 with 50 employees, QMS specialists and many new positions in organizations in Washington DC. At the same time the staffing in the ACOs stayed stagnant. The focus was not oversight and having a second set of FAA safety engineering eyes reviewing designs and doing oversight.

[19] The PDI report includes a discussion of false information provided to Congress in the "312" report claiming increasing numbers of certification projects and AD actions. This was not true at the time of the report. Increased UAV and electric propulsion technologies evolving since the report may increase the need for safety engineer staffing, but the increase is relatively small.

competency[20] and the current systems puts barriers to open communication with the FAA. In fact Boeing has an internal requirement that ARs must obtain permission to contact the FAA. Discussion with the General Electric ODA manager indicated they have been told by FAA managers in the New England Office not to have ARs call the FAA because the local office does not have resources to answer questions. Boeing has demonstrated their ODA is not acting as an independent organization, and the ODA is not forcing the company to produce a compliant design. If fact in a number of instances the ODA argues with the FAA over the intent of regulations and policy rather than carrying out their mandate as an ODA. Examples available upon request.

Recommended Actions: The table below includes recommendations intended to address shortfalls identified by NTSB, JATR and FAA safety engineers. Several recommendations would rescind certain company ODA functions and restore direct FAA selection, competency and communication with the company designees based upon the proven practices of the earlier DER system. (These recommendations do not address possible flaws in the oversight of manufacturing quality that has been the focus of recent articles regarding the 787 production in SC. The FAA has also relied upon a delegation process for manufacturing oversight and any flaws in that process should also be addressed.)

United States Aviation Safety Excellence Act	New law would include provisions as listed below.
Rescind significant portions of the Organization Delegation Authority. Re-implement FAA direct approval and selection and evaluation of competency of Designated Engineering Representatives.	Grounding of the 787 and 737 MAX shows this concept does not work. In addition to the failure of the system, it is very inefficient since the companies must staff large ODA organizations and the FAA must also have staff to do audits of the ODA. The companies take on all the liability for accidents such as the 737 MAX. The FAA expends large resources doing oversight/audits that could be focused on direct oversight. The Boeing Aviation Safety Oversight Office currently has 4 managers and an authorized staff of over 40 Bargaining Unit Employees. (see suggested elimination of BASOO and moving certification oversight responsibility and staffing to the Seattle Aircraft Certification office as described below)
Mandate removal of all incentives from FAA	Currently it appears significant portions of

[20] To increase profits, Boeing actually transferred a number of highly paid positions out of Washington State such that many of the experienced engineers retired- (several came to the FAA rather than move out of state). They were replaced with new or foreign engineers that had lower costs. [redacted] can provide details)

manager's performance criteria that are tied to meeting industry schedules and needs. Add a requirement that the manager's performance be tied to the results of an annual employee safety culture survey.	manager's bonuses are based upon meeting industry needs. Incentivizing managers to push certification over safety is contrary to reaching a healthy safety culture.
Amend the Changed Product Rule (§21.101) to put a time limit on Type Certificates of 25 years and to require the applicant to request an exemption for any design change that will not meet the latest standards.	The Changed Product rule was originally intended to force applicants to "step up" to the latest safety standards. The rule is not effective because the FAA has not required applicants to meet later standards because of the "exceptions" provision of the rule. The 737 Max flight deck was based on technology prior to 1982 (EICAS introduced on 767) and did not meet flight crew interface safety standards of §§ 25.1302 & 1322. Meeting this requirement would have prevented the accidents.
Mandate implementation of a third party, anonymous safety reporting system similar to the operational system developed for pilot reports that is administered by NASA. Instances of any safety and undue pressure events could be reported by FAA safety engineers, and company designees.	Currently NATCA and the FAA have a Memorandum of understanding in place that fulfills a contractual requirement for the FAA to have a safety reporting system. The system is set up with a 4 person board made up of 2 FAA managers and 2 NATCA safety representatives. The board receives anonymous safety reports and often tasks technical specialist panels to review the concern and provide recommendations. The 737 rudder cables, 787 lightning protection and many other issues have been submitted to this system and the Board had issued a number of recommendations back to senior FAA managers. The managers have not addressed the safety issues. The SRP must be expanded to include undue pressure and be administered by a third party such as NASA and/or NTSB. [redacted] is currently directing AVS to work with the unions to implement a new safety reporting system but the new system does not include any third party participation , allow for designees to report, and does not provide an annual report to Congress on the outcome of all reports.
Mandate a quarterly report from the FAA Administrator to the House Aviation Oversight Committee of all SRP reports and resolution actions.	This report could be made public and allow visibility of an open safety conscious culture.

Mandate that all non-compliances found on certified products must be brought back into compliance on both production and previously produced aircraft[21]	During initial certification of the 737 Max, Boeing delayed any action to make design changes to provide a compliant design. (list available). EASA identified 3 non compliances and held up certification for a short time. Boeing received type design approval and was rewarded for their action. Mandating that all non-compliances are fixed in production and retrofitted into the previously produced airplanes would provide a big incentive for companies to produce a compliant design since the post certification cost to fix the known non-compliance would well exceed the initial cost. Currently there is a provision in the ODA criteria for the holder to disclose non compliances, but Boeing is not required to bring the airplanes back into compliance and the provision does not require retrofit of the changes. (there were 98 non compliances disclosed on the 787 during the first year of production)
Mandate formation of senior specialist technical teams (grey beard) to evaluate certification project design and establish all retained certification items, special conditions and issue papers at beginning of certification project based upon risk based criteria.	The grey beard teams would cover each technical discipline and be made up of senior/experienced FAA engineers, Chief Scientist and Technical Advisors, and academia as needed for new technologies. This process would help in training new safety engineers and optimize the technical competency within the agency. **Note:** the FAA had one safety engineer who was a former Boeing flight controls engineer with 10 years of experience in the 737 flight controls group at Boeing. This specialist was not consulted in regard to the original type design approval of MCAS or asked to review flight crew procedures issued with the Airworthiness Directive following Lyon Air. The engineer would likely have caught the error in the procedures that did not mandate neutralizing the column forces before disconnecting the MCAS.
Mandate Establishing delegation risk review board (DRRB) process for the Aircraft Certification Offices-. This process is similar	Board evaluates all retained items and delegation status established by grey beard team. Retention and delegation status can only

[21] See detailed white paper in PDI report written by [redacted] - highly knowledgeable recently retired FAA attorney

to the Continued Operational Safety process where safety issues are brought before the CARB.	be changed by board review through a risk based methodology that includes documentation of how the decision was made. This system eliminates individual managers from making delegation decisions based upon political/manufacturer pressure and returns the decision process to a safety/risk basis.
Mandate FAA retention and review of all system safety assessments.	The accuracy of the safety assessments is critical to airplane safety and often include subjective assumptions that must be evaluated by a second set of eyes, the FAA safety engineers. The FAA should require all SSA to have all assumptions listed in the front section of the SSA and that all are retained. FAA engineers should be required to approve all SSA that result in catastrophic, hazardous or Major failures and to approve the classification for any failures stated to have minor effects.
Mandate applicant validation of all assumptions in safety assessments,	The 737 MAX MCAS safety assessment had numerous invalid assumptions. The applicant (Boeing) claimed its certification process did not require validating the assumptions. Every assumption should be supported by a documented source and validated/accepted by the FAA. The flight crew procedures utilized in the initial AD action after the first accident were not validated and this shows the importance of validating all assumptions is to the safety of the product.
Mandate development of expanded flight crew/cockpit interface evaluation utilizing a spectrum of expected pilot skills	FAA and industry have typically relied on "top gun" piloting skills when evaluating crew reaction times and expected responses. This is not consistent with variations in the pilot community who operate world transport airplane fleets. In no way should anyone blame the pilots in either of the two MCAS accidents, but the accidents showed flawed safety assessments related to assumptions about human factors.
Mandate FAA implement a risk based oversight program	This sounds like an obvious requirement that should already be in place. FAA managers will say they focus resources on high risk items but this is not true. Over 95 percent of the brand new high technology 787 was delegated. The 787 lithium batteries were delegated to Boeing. So was the MCAS on the 737 MAX.

	These delegation decisions were based on Boeing pressure, not a thoughtful risk based assessment. The IG has recommended the FAA implement a risk based delegation tool but to date the agency has not mandated a tool be developed and used. Without a tool and defined criterion, managers are put under political pressure to delegate findings late in the program, even when the finding is high risk.
Mandate eliminating the BASOO and focusing all resources on staffing the SACO. • Reallocate engineering positions from BASOO and AIR300 to certification oversight-AIR 700. • Add an additional 100 safety engineering positions AIR wide.	The organizational structure when the BASOO was created resulted in inherent under staffing and lack of experienced safety engineers. Prior to the BASOO, the SACO had a staff of many flight controls specialists including senior engineers and a manager with flight controls background. The SACO staff had significant resources and expertise to do oversight of Boeing. Conversely, the BASOO had only 2 flight controls specialists for all Boeing programs and both had very limited experience. Both were low paid government pay scale "I band" engineers. Neither had flight controls, or even 737 systems experience/training. Currently there are 4 managers and over 40 authorized positions in the BASOO. There are 49 positions in AIR 300. These are all added positions since delegation to the Boeing ODA was initiated. Prior to the ODA, all certification oversight was done by the Seattle Aircraft Certification Office. AIR has significantly increased staffing over the last 10 years including creating whole new organizations, like AIR300 and added staffing in Washington DC away from the field offices doing certification. The number of certification projects has remained stable. Yet the agency continues to argue there are not enough resources to do oversight. This is not supported by facts. Managers chose not to allocate resources to certification oversight and appropriate staffing. With fewer staff the SACO certified the highly successful 757.767, 777, 747-400.

Fund an additional 100 safety engineer positions	These positions are needed to address shortfalls in field offices and creation of adequate staffing to address new technologies like UAV and electric propulsion systems.
Mandate DER and FAA safety engineer proficiency demonstration for the disciplines they are authorized as designees or oversight responsibilities.	Due to high turnover of senior staff at companies and FAA, proficiency demonstration similar to a Professional Engineer licenses should be required. ASTM with NATCA participation has developed standards that are being published. We have licensing for engineers and mechanics but no metrics for evaluating the competency of engineers acting as unit members for the FAA, or for FAA engineers doing oversight and making critical safety decisions. (more information on the this program can be provided by [redacted].
Allocate funding for additional online training and technical proficiency substantiation	Online courses are very effective and more limited courses are available due to funding.
Upgrade Safety engineers from I to J pay band, add K band grades for senior engineers and technical specialists responsible for new technologies.[22]	Currently attracting and retaining technical specialists in safety engineer positions is difficult due to pay well below industry standards. The safety engineers are the lowest paid in certification offices resulting in inexperienced engineers in safety critical positions, resulting in high turnover. Expanding the pay band to K level will allow retention of FAA specialists and hiring of industry specialists for evolving complex technologies **Note**: that high school educated employees are paid J band level pay for doing oversight of airline maintenance programs.
Pass law rescinding executive order to eliminate 2 rules for every new rule issued	The order results in needing to rescind over 10 rules in order to issue one new rule. This is due to the way the cost benefit analysis is conducted. The order makes it impossible to do any meaningful rulemaking and puts the FAA well behind EASA, which is issuing new rules and has become the world leader in aviation

[22] Statements have been made that the FAA engineers lacked the technical competency to conduct oversight of highly complex aircraft. While it is true the complexity of aircraft is increasing, the grounding of the 787 and the 737 MAX accidents did not result due to the complexity of the design or technical competency deficiency. The battery was identified as an unsafe design in the first meeting with Boeing. A first year engineering student would have easily seen the single angle of attach vane design on the MAX did not meet basic fail safe engineering practices. Upgrading technical competency in the area of system safety assessment and other key technologies is a valid need, but should not be tied to the grounding of the two airplane models.

	safety.
Renegotiate bilateral agreements that prohibit FAA safety engineer involvement in issuance of US type certificates for foreign products.	The FAA recently expanded acceptance of bilateral agreements and implementation procedures that force almost no FAA involvement in certification of foreign airplanes that make up much of the US fleet. FAA engineers routinely find problems on foreign airplanes that are addressed prior to FAA type certification. These safety "saves" were not considered in the decision to expand the bilateral agreements. Bilateral review by teams of safety engineers from multiple regulatory authorities produces the highest level of safety. This has been shown during the MCAS review. **Note,** Boeing had significant concerns with China stealing trade secrets during 787 approval in China. This is a valid concern but expanding bilateral approvals is a serious mistake. This could have dramatic long term consequences in US aviation system safety.
Hire additional System Safety Chief Scientists and Technical Advisor (CSTA) for Aircraft Certification and several K band Senior Engineer positions	Currently we have one System Safety CSTA, [redacted] We need several more due to the proliferation of complex systems in modern aircraft and the reliance on system safety approaches for certification of these systems. The FAA needs to increase competency in software and other new technologies.
Mandate FAA reorganization of the Certification Service back to a directorate system. The current functional organizational structure being implemented by FAA management dilutes technical proficiency in highly complex products and diminishes FAA ability to maintain high technical competency.	The Directorate system was developed after failure of the earlier system was apparent during the DC-10 cargo door investigation. The Directorate system was proven to produce the safest time in aviation history. No justification for reorganization was provided. ([redacted] has accelerated the reorganization in the midst of the MAX investigations and pending recommendations from many parties. Waiting to see the recommendations is prudent.)
Mandate charging foreign applicants for FAA certification of their products similar to EASA	US manufacturers pay significant funds to foreign authorities to cover cost of receiving a foreign type design approval. The US does not charge for our services. To level the playing field and provide additional funding to the FAA, the US should charge any country that charges our applicants.

Appendix 1: FAA Management – Selected for Promoting Industry not Safety

The safety culture at the top of the FAA has cascaded down the organizational chart to the lowest level management in safety offices across the country. The agency Aircraft Certification Service leadership includes former members of industry with strong records of advocating for reducing FAA oversight and eliminating FAA safety regulations. Starting at the top of the organization is the Associate Administrator of Safety, [redacted]. [redacted] started his career in Los Angeles as an engineer and DER at McDonnell Douglas Corporation and moved to Seattle after the merger. He became the SACO manager and ultimately the Transport Airplane Directorate manager while advocating for delegation. He pushed to develop the BASOO and handpicked the manager and the engineers who staffed the small office. He was the only FAA representative on the "312" committee that provided recommendations to expand delegation (PDI report documents misleading recommendations in the 312 recommendations). He left the FAA after the grounding of the 787 that occurred under his authority and became a vice president of AIA's Civil Aviation division. AIA is an industry group funded by companies he was overseeing as directorate manager. He has testified in front of Congress while working for the AIA pushing for more delegation of compliance to industry.

The Executive Director of the Federal Aviation Administration's (FAA) Aircraft Certification Service is [redacted], who is responsible for type certification, and continued airworthiness of the U.S. civil aircraft fleet - including commercial and general aviation activities. [redacted] was VP of Industry and regulatory affairs at the Experimental Aircraft Association. After coming to the FAA he oversaw rewrite of the Part 23 safety regulations to eliminate many prescriptive performance requirements and adopt "industry consensus standards" and is currently expediting the effort to implement reorganization of the Aircraft Certification Service. He has no experience with transport airplane certification and has made numerous comments that show his affinity toward industry. At an all hands meeting in Seattle following the two accidents he told all employees Boeing was responsible for safety, not the FAA, and that Boeing must have an SMS. He also stated his plan to convert all of part 25 to consensus industry standards and has hired a special manager to oversee the conversion. [redacted] also stated he did not foresee any significant changes to the delegation process and that his discussions with congressional staffers indicated their statements about change were "just for the cameras". In answering a question about how to retain and hire technically competent safety engineers he stated his plan is to hire 100 engineers directly from Emery Riddle College. He stated [redacted] supported this effort. Clearly this concept flies in the face of addressing the recommendations to enhance FAA technical competency.

The Policy and Innovation Division is led by [redacted][23] who was previously employed by Sikorski, Pratt and Whitney and the AIA. [redacted] came to the FAA from the AIA after [redacted] moved back to the FAA. He is another industry person put in a leadership position by [redacted] and is a strong advocate for converting Part 25 to consensus industry standards.

[23] Before the FAA, [redacted] was Vice President of Civil Aviation at the Aerospace Industries Association, where he oversaw all activities on aviation-related issues and policy, including the areas of research and development, aviation infrastructure, and safety and security. At the same time, he was President of the National Center for Advanced Technologies, a non-profit corporation that assists the federal government by developing cooperative links between government, academia, and business on policy issues, with a focus on civil and military aerospace research and development. [redacted] also held position as the Director of Product Safety, Certification and Airworthiness at Sikorsky Aircraft with responsibilities spanning their entire product line. Before joining Sikorsky, he held a similar role at Pratt and Whitney.