

Testimony of Captain Joseph G. DePete, President, Air Line Pilots Association, International

Aviation Subcommittee Hearing

**“Starships and Stripes Forever – An Examination of the FAA’s Role in the Future of
Spaceflight.”**

U.S. House of Representatives Committee on Transportation and Infrastructure

June 16, 2021

On behalf of the Air Line Pilots Association, International (ALPA), I want to thank you, Chairman Larsen and Ranking Member Graves, for inviting me to testify on the very important role that the Federal Aviation Administration (FAA) has in the future of spaceflight. My name is Captain Joe DePete, and I serve as the president of ALPA. ALPA is the largest airline pilot union in the world, as well as the largest nongovernmental aviation safety organization in the world, with a history of safety advocacy spanning more than 90 years

ALPA's focus on spaceflight operational integration has been ongoing for more than five years and our primary focus is on ensuring that no new risks to airline operations are introduced by space operations. Based on recent events, there is a lot of work that needs to be done very quickly by the FAA in cooperation with other parts of government to ensure that the skies occupied by airline traffic remain safe, as the frequency of commercial space operations continue to climb.

Collaboration with Commercial Space Industry

ALPA is a tremendous supporter of our Nation's commercial space industry. I am proud of the role that we have had in increasing collaboration that has occurred between the space and airline industry stakeholders. ALPA has worked particularly hard to reach across the aisle and engage in meaningful discussions with the commercial space industry members represented by the Commercial Spaceflight Federation (CSF). We have also worked to bring other aviation industry representatives into the discussion. Our interactions were brought onto a more public stage in October of 2019, when ALPA and the CSF jointly held a 1-day symposium called *Safe Skies for All: Introducing Spaceflight Into Our Skies*. The culmination of that day was a joint

statement on the need to collaborate and work as two separate industries towards a common goal. We said:

ALPA and CSF vow to continue to work together to improve the commercial aviation and space community's understanding of each other's technologies, operations, and constraints; to explore potential solutions to conflicting demands for airspace; and to advocate for optimized use of airspace around launch and reentry activities. We agree that the status quo cannot continue and the private sector must help the FAA innovate to minimize any negative impacts of the growing commercial aviation and space industries. As leaders of our respective industries, ALPA and CSF have taken cooperative action to solve these problems. We're working with colleagues and other key stakeholders to improve how we operate today, as well as advocating for investments in new air traffic control tools that will better optimize airspace while preserving safety as we enjoy future growth in both air and space transportation.

It is with this continued spirit of collaboration that I sit here today and share with you, our thoughts on the FAA's role in the future of commercial spaceflight.

Space Launch Activities Forecast to Rise

During the 2020 global pandemic, the FAA continued to approve commercial space launches, most of which depart and fly over oceanic airspace. However, domestic sub-orbital launches are expected to commence in the near future and each launch will require the FAA to protect large swaths of airspace just in case a space operation fails to achieve its planned operation.

The rate of rocket launch activities is accelerating. Worldwide, the number of space launches increased by 54%, from 74 launches in 2010 to 114 launches in calendar year 2020¹. This trend is expected to continue through the 2020s, with the FAA Office of Commercial Space forecasting a further increase between 36% to 100% in the U.S. alone by the fiscal year 2025. Industry estimates are even higher with a fiscal year 2025 growth of 177% over 2020².

I would like to discuss three areas with you today. From an airline pilot perspective, they are the three most pressing safety issues that need to be addressed by the FAA. I believe that it is very important that the FAA take both strategic and tactical leadership actions on these critical safety concerns.

A Systematic Space Integration Strategy Is [Still] Needed

In our 2018 white paper, *Addressing the Challenges to Aviation from Evolving Space Transportation*, we highlighted the numerous challenges that the tremendous growth in commercial space operations will present to the nation, including space operator approval, spaceport licensing, regulations for spacecraft crew and participants, spacecraft design standards, and other critical areas. It is ALPA's belief that the number of commercial space launches and recoveries will rapidly escalate in the next ten years, and that the U.S. will lead by example in successful commercial space operations that are safely-integrated with the commercial aviation industry. Our carefully chosen words at that time still ring true today:

¹ <https://www.spacelaunchreport.com/logyear.html>

² https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/Commercial_Space.pdf

The FAA needs a comprehensive plan to integrate commercial space operations and avoid major disruptions for the other users of the NAS as the demand for access to the NAS for commercial space operations increases. As commercial space operations increase, and as the commercial space operations locations continue to expand...[there is a need] to reduce NAS impacts while maintaining a high level of safety. At some point, segregation of commercial aviation operations from commercial space operations will not be a viable solution.

In the years that have passed since ALPA penned those words, we have seen some progress in the most publicly visible “pain point” for the traveling public: launch induced delays. We have seen the space industry and the FAA work to create systems and procedures to better disseminate information for air traffic controllers and airline operations centers, and we have seen a high degree of launch vehicle performance and reliability as American astronauts have resumed their travel on American rockets. All of these positive steps are evidence of continuous improvements of spaceflight *accommodation*. However, ALPA has not seen any of the much needed steps by the FAA, to start the *integration* process. We believe that now more than ever, a comprehensive strategy is needed, so that we do not lose sight of the ultimate goal. Areas that must be addressed in this strategy, include:

- A comprehensive system safety performance framework including both hardware and software standards designed for normal and non-normal operations.
- Safety Management System for manufacturing, operations, and spaceport licensing.

- A comprehensive plan for airspace management coordination tools and capabilities
- Orbital debris reentry standards as well as a comprehensive plan for when orbital debris may impact aviation operations.
- Astronaut licensing, training and recurrency standards associated with the operation in the National Airspace System

We are concerned that without a strategy, safety risks may either be under-rated or unidentified altogether. However, it is important to note that we are not asking the FAA to regulate the Commercial Space industry as if they are starting from square one or to dramatically impose severe constraints. The industry is very successful at what they do, and each successful rocket launch proves this point. Instead, we are encouraging all stakeholders to jointly develop and define a goal for the future and then ensure that each decision point made along the way is consistent with that envisioned operational future. If we do not have a common goal in mind, and if it is not a shared goal, then we cannot create a shared mental model of the various strategies that we can collectively and individually use to reach the envisioned level of safety with full operational integration.

Creating a Shared Mental Model on Integration

There is another aspect of strategic thinking that I know the FAA can immediately implement, without any funding or authorization: Establish an overarching integration advisory structure. I realize that we are discussing the topic of space operations today. However, I believe that the FAA needs to hear from the breadth of our Nation's airspace operators from a single vantage

point on integration of all types of aircraft and spacecraft. I also believe that the aviation and space segments need to create a “shared mental model” where there is broad agreement on how the airspace will be used in the future. But we cannot create a shared mental model if we do not get all of the players together, along with the FAA, at the same table.

It strikes me as odd that the FAA’s various operational advisory committees do not interact with each other. They are by definition, segregated. This segregation into narrow focus areas includes commercial space, drones and aviation. Each industry segment has their respective advisory committee including the Commercial Space Transportation Advisory Committee (COMSTAC), the Drone Advisory Committee (DAC), and the NextGen Advisory Committee (NAC). However these segregated committees never interact, or step back to see how their needs affect other airspace operators. We need de-segregation of the airspace user community.

If the FAA were to establish a broader integration committee, it would also mean that they should cross-pollinate the commercial space industry into mainstream aviation industry advisory committees. I will forever remember my first visit to the Commercial Space Transportation Advisory Committee (COMSTAC) meeting in the gallery as a member of the public. At that meeting I took the opportunity to share my belief that we are stronger working together than we are working independently. I shared my passion for a proactive safety risk mitigation philosophy instead of the reactive or forensic based safety advancement model. I was able to share the facts about how much safer the airline industry has become with

proactive, data-driven safety risk analysis. I was very excited when multiple COMSTAC members engaged in a discussion that was neither scheduled nor scripted. We took the time to collaborate and began developing a common understanding of each industries airspace needs and safety requirements. That left a very distinct feeling of hope and optimism that someday we will all be working together to achieve incredible results that are mutually beneficial to all Americans now matter what their airspace needs would be.

In my time serving as ALPA president and before that, as First Vice President and National Safety Coordinator I have had the privilege of serving on numerous Federal Advisory Committees and I fully support an integrated group of stakeholders who jointly need to be tasked by the FAA to provide valuable feedback on important safety and operational topics relevant to all airspace users. It's our recommendation that the FAA:

- Identify a means by which to obtain an integrated set of industry recommendations on how to successfully achieve future operations.
- Review the structure of the current committees and find a way to develop recommendations with an underlying assumption that the FAA will continue to oversee the operations of all aircraft and spacecraft in the National Airspace System (NAS), which will continue to be a national resource to be shared by all.
- Seek input on a consensus based strategic plan with a target date for commercial space integration that allows the Commercial Space operators to “file and fly” without segregation / sterilization of airspace areas.

I believe that these strategic steps are the right steps for the FAA to take in support of the future of our country and our country's airspace system.

Focus on Environmental Impact

It should not need to be said, that there is critical work to be done immediately to limit the environmental impact from commercial space operations. While the focus on environmental impact may not have been considered a significant concern in the past when space operations were less frequent, the increased frequency of the launches today dictates a necessity to address the environmental impacts associated with commercial space launches. Many rocket launches utilize fossil fuels, and the carbon emissions from a rocket launch are easily measurable. They can be reduced through an increased focus on environmental impacts. With rocket launches combined with the added fuel burn required by aircraft due to flight diversions around airspace designated for rocket launches, the total impact of space operations should be recognized and address as part of the FAA's focus going forward. Developing alternative fuel strategies in addition to developing and implementing the Commercial Space integration strategy as quickly as possible is critical. We must not allow any airspace user to be given a "hall pass" on this important topic.

Near-Term Concerns

In addition to the strategic activities that we believe the FAA should be fostering, I would also like to take a few minutes and highlight real-world examples of operational issues that airline pilots must contend with today, that have not been an issue until relatively recently.

Uncontrolled Rocket Re-Entry Events

Two recent uncontrolled and unscheduled space debris re-entry events have exposed a troubling trend. The events include a March 25, 2021 Space-X Falcon 9 second stage re-entry over the Northwestern United States and Southwestern Canada, and a Long March CZ-5B-Y1 rocket on May 9, 2021, in the Indian Ocean. In the span of just 45 days, many tons of rocket components have re-entered the atmosphere as out-of-control space debris, putting many lives at risk. This includes those lives that were in-flight on airline aircraft and were likely unaware of the potential danger that they might encounter. Only after the re-entry had occurred, did the real safety threat become much more obvious.

In the case of the Space-X re-entry, we know that the second stage did not have sufficient propellant left to have a controlled de-orbit, and therefore Space-X lost control of the booster, which was left orbiting the earth for weeks (not hours or days) before its re-entry. There was ample time to evaluate and plan for any potential risks resulting from the unplanned re-entry. Despite the second stage design to minimize debris, several components did survive re-entry and impacted the ground.

In the days following the March 25 re-entry, several pieces of the Space-X second stage were recovered, and some of them reportedly weighed upwards of 300 pounds (136.7 kg). We are unaware of any warnings or cautions issued by Space X, or either of the Air Navigation Service Providers (ANSPs) in the U.S. or Canada, once it was known that the re-entry could occur in continental U.S. and Canadian airspace. We are also unaware of any warnings issued by public safety agencies to generally alert the global aviation community in advance of the event.

The second re-entry event involved a Long March CZ-5B-Y1 rocket, which was among the 10 largest pieces of human-made space debris to ever re-enter the earth's atmosphere. The rocket booster re-entered over the Indian Ocean approximately 50 minutes earlier than the final prediction provided by The Aerospace Corporation. If it had re-entered 15 minutes later than predicted, it would have occurred over central Florida. If re-entry had occurred 105 minutes later than predicted, it would have been over Washington, DC, and much of the continental U.S. in the moments before that.

In May 2020, a similar Long March CZ-5B-Y1 rocket also re-entered the atmosphere and like the Space-X Falcon 9, some of the booster components fell all the way to the ground, within the Republic of Côte d'Ivoire. Publicly available news reports indicate that another CZ-5B-Y1 booster will be used in the near future, and a re-entry event like the May 9 event will occur again.

Publicly, news agencies and experts report that this rocket booster is not equipped with the capability to ensure that its re-entry can be controlled, or even accurately predicted.

The airline industry long ago realized that the “big sky theory” was not an acceptable collision risk mitigation strategy, and yet there seems to be an ongoing view that the “big sky theory” is an acceptable risk for space debris re-entry. The problem becomes even more apparent when looking at the forecast for increased future launches.

Thus, the two uncontrolled re-entry events and the risk they pose to aviation are noteworthy, given the strong safety record the airline industry in the U.S. has worked so hard to achieve.

Although neither event created an aviation or ground-related casualty, several issues have been identified by ALPA that we believe are a global threat to aviation safety and need to be addressed by the FAA.

- The need for standards for launch planning and recovery, as well as risk mitigation, should unplanned events occur during the launch and recovery.
- The need for standards for space debris that at a minimum, includes “design for demise” requirements, as well as vehicle design requirements to ensure that very large pieces of space debris are controllable enough to ensure that the re-entry occurs at a pre-defined location and time.
- The FAA and their government agency partners need to greatly increase information dissemination before and during re-entry events, so that aviation operations have

adequate advance notice, as well as ongoing updates on the re-entry data as it becomes available. Even if there are “design to demise” plans in place, the risk of an unanticipated space debris reentry needs to be communicated. If necessary, the FAA air traffic control should direct pilots away from possible areas at risk to collisions from components that are falling through the airspace, during the re-entry.

It is important to recognize that this is not just an issue that we must face as a Nation, it is a global issue. Therefore, last month I sent an urgent letter of request to the ICAO Secretary General with many of these same facts and concerns, and I asked the Secretary General to begin work immediately to address the global risks to passengers and flight crews from space debris reentry. I continue to anxiously wait for a response. A copy of the letter is included at the end of my statement.

Elevated Levels of Risk in the Vicinity of Space Operations

As discussed earlier, prior to each rocket launch, the FAA air traffic controllers work to clear the airspace in the vicinity of the launch pad and under the rocket’s planned flight path to orbit.

The airspace is also sterilized for any of the boosters that return to earth, as part of the rocket operation. The size and duration of the airspace is relative to the size and complexity of each rocket launch operation.

The FAA has recently implemented an airspace risk mitigation procedure called Acceptable Level of Risk (ALR)³. In the simplest of terms, ALR reduces the volume of airspace that is segregated based on the results of mathematical risk analysis, which shows that risks of exposure to a rocket mishap is acceptable based on the time an aircraft will operate in areas of higher risk and potentially be exposed to rocket debris. While this is not a secret policy change, the FAA does not sufficiently notify pilots, airlines, or controllers not directly involved in a space launch of these changes in risk levels of airspace near the rocket launches, rocket reentry, launch trajectory zones, or of off-nominal events. Additionally, the FAA does not provide pilots or dispatchers with maps, coordinates or other details about the ALR airspace zones in which there is a reduced level of safety.

ALPA has raised questions and have expressed concerns on numerous occasions, about the lack of information disseminated to line pilots about ALR operations, and the increased level of risk that pilots are being asked to accept, most of the time unbeknown to them. ALPA believes operators of the NAS (pilots and controllers) need to be provided with ALR related information prior to every flight that will be exposed to ALR operations, and we believe that the FAA needs to publish clear guidance on the ALR operations so that pilots can make an informed decision about their flight's exposure to the ALR airspace area. ALPA recommends that the FAA:

³ For a description of the FAA ALR see the document at the following web link:
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/risk_management/media/2018-04-27-FAASRMGuidance-ALR_signed_508.pdf

- Develop and distribute educational materials, as well as update the Aeronautical Information Manual (AIM) explaining the ALR concept, the risks that the FAA has identified when operating in the ALR airspace and describe the type of air traffic control services available to pilots should the need arise. The FAA should also include instructions on how pilots can elect to avoid the ALR airspace if they prefer.
- For each rocket launch that utilizes ALR airspace risk mitigation procedures, publish Notices to Airmen with graphical depictions and information that can be displayed on a map, of the ALR airspace area that includes relevant navigation airways and waypoints, so that pilots, dispatchers, and airlines can evaluate the risks to their flight, by understanding the size, location and duration of the time they are operating in ALR airspace.
- Ensure that air traffic controllers have adequate tools and capabilities to provide flight crews with air traffic services for all operations in the vicinity of rocket launches, reentries, and during off-nominal events.

I often refer to ALPA members as “front line workers.” Whether they are working day-in and day-out during a global pandemic and the risks to their health during their work day, or whether they are flying in ALR airspace or in a portion of the sky where there is the potential for rocket debris re-entering the atmosphere above them, airline pilots are continuously focused on ensuring that their passengers, cabin crew members, and cargo reach their destination safely. However, ALPA pilots are not alone in this effort to achieve the highest levels of safety. Instead, airline pilots rely on air traffic controllers, dispatchers and our fellow crew members in

the cabin to help us safely complete each and every flight. The need for information dissemination across all of these worker groups is critical, and until we have a solid framework in place to ensure every user of the airspace is aware of the risks of a space debris reentry, and understands ALR operations and their expected roles, we believe that the FAA has important steps to take immediately. We should not be allowing any airspace operator to be unaware of either of these very important safety issues.

Conclusion

The level of safety that the traveling public has come to expect cannot be maintained in the future world where rocket launches are expected to be a frequent occurrence across our great nation, without a strategy to get us there. It's a very important step to take. But while we work on that strategy, we urgently need to work on the exchange and dissemination of what I would consider to be mission-critical operational information. The uncontrollable re-entry of a large piece of space debris into the atmosphere over domestic airspace, and the ALR airspace concept are two very appropriate examples of the type of information that would be very beneficial to pilots who are striving to complete their safety mission.

ALPA stands by as a committed, willing partner as we continue to chart a path on these very important topics into the future. We appreciate your recognition of the unique and critical role played by pilots and all airline workers to safely maintain our air transportation system, support our national economy, and position both the aviation and the space industry for seamless operations in the future. Along with these suggestions, please accept our offer to provide the necessary personnel from ALPA to assist the FAA in these activities. I firmly believe that the

FAA is well-positioned to immediately address the issues. I stand firm in the belief that through collaboration and a common goal to achieve the highest possible safety levels, that the space community and the aviation community can rise above the challenges we are currently facing to the benefit of all humanity. Thank you for your continued oversight of this very important topic.



AIR LINE PILOTS ASSOCIATION, INTERNATIONAL

7950 Jones Branch Drive, Suite 400S | McLean, VA 22102 | 703-689-2270 | 888-FLY-ALPA

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May 14, 2021

Dr. Fang Liu
Secretary General
International Civil Aviation Organization (ICAO)
999 Robert-Bourassa Boulevard
Montréal, Québec H3C 5H7
Canada

Dear Secretary-General Liu:

The Air Line Pilots Association, International (ALPA), representing the safety interests of over 59,000 professional airline pilots flying for 35 airlines in the United States (U.S.) and Canada, has closely monitored the rapid increase in global space operations. Our focus on space flight operational integration has been ongoing for more than five years and our concerns are primarily focused on ensuring that no new risks to airline operations are introduced by space operations. Based on recent events, we believe that there is a lot of work that needs to be done very quickly and I ask that International Civil Aviation Organization (ICAO) take leadership on this critical safety concern.

Two recent uncontrolled and unscheduled space debris re-entry events have exposed a major risk. The events include a March 25, 2021 Space-X Falcon 9 second stage re-entry over the Northwestern United States and Southwestern Canada, and a CZ-5B-Y1 rocket on May 9, 2021, in the Indian Ocean. In the span of just 45 days, many tons of rocket components have re-entered the atmosphere as out-of-control space debris, putting many lives at risk. This includes those lives that were in-flight on airline aircraft and were likely unaware of the potential danger that they might encounter. Only after the re-entry had occurred, did the real safety threat become much more obvious.

In the case of the Space-X re-entry, we know that the second stage encountered a mechanical difficulty and was adrift, orbiting the earth for weeks before its re-entry. There was ample time to evaluate and plan for any potential risks resulting from the unplanned re-entry. Despite the second stage design to minimize debris, several components of the Falcon 9 did survive re-entry and impacted the ground.

In the days following the March 25 re-entry, several pieces of the Space-X second stage were recovered, and some of them reportedly weighed upwards of 300 pounds (136.7 kg). We are unaware of any warnings or cautions issued by Space X, or either of the Air Navigation Service Providers (ANSPs) in the U.S. or Canada, once it was known that the re-entry would occur in

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The second re-entry event involved a CZ-5B-Y1 rocket, which was among the 10 largest pieces of human-made space debris to re-enter the earth's atmosphere. The rocket booster re-entered over the Indian Ocean approximately 50 minutes earlier than the final prediction provided by The Aerospace Corporation. If it had re-entered 15 minutes later than predicted, it would have occurred over central Florida. If re-entry had occurred 105 minutes later than predicted, it would have been over Washington, DC, and much of the continental U.S. in the moments before that.

In May 2020, a CZ-58-Y1 rocket also re-entered the atmosphere and like the Space-X Falcon 9, some of the booster components fell all the way to the ground, within the Republic of Côte d'Ivoire. Publicly available news reports indicate that another CZ-5B-Y1 booster will be used in the near future, and a re-entry event like the May 9 event will occur again. Publicly, news agencies and experts report that this rocket booster is not equipped with the capability to ensure that its re-entry can be controlled, or even accurately predicted.

The airline industry long ago realized that the "big sky theory" was not an acceptable collision risk mitigation strategy, and yet there seems to be an ongoing view that the "big sky theory" is an acceptable level of risk for space debris re-entry. The problem becomes even more apparent when looking at the forecast for future launches. Worldwide, the number of space launches increased by 54%, from 74 launches in 2010 to 114 launches in 2020⁴. This trend is expected to continue through the 2020s, with The U.S. Federal Aviation Administration (FAA) Office of Commercial Space forecasting a further increase between 36% to 100% in the U.S. alone by the fiscal year 2025. Industry estimates are even higher with a fiscal 2025 growth of 177% over 2020⁵.

Thus, the two uncontrolled re-entry events and the risk they pose to aviation are noteworthy, given the strong global safety record the global aviation industry has worked so hard to achieve. Although neither event created an aviation-related casualty, several issues have been identified by ALPA that we believe are a global threat to aviation safety and need to be addressed by ICAO.

- The need for globally accepted standards for launch planning and recovery, as well as risk mitigation, should unplanned events occur during the launch and recovery.
- The need for globally accepted standards for space debris that at a minimum, includes "design for demise" requirements, as well as vehicle design requirements to ensure that very large pieces of space debris are controllable enough to ensure that the re-entry occurs at a pre-defined location and time.
- States need to greatly increase information dissemination before and during the re-entry events, so that aviation operations have adequate advance notice, as well as ongoing updates on the re-entry data as it becomes available. If necessary, actions by ANSPs

⁴ <https://www.spacelaunchreport.com/logyear.html>

⁵ https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/Commercial_Space.pdf

should be taken so that aircraft are cleared from possible areas at risk to collisions from components that are falling through the airspace, during the re-entry.

Along with these suggestions, please accept our offer to provide the necessary personnel from ALPA to assist you in this activity. I firmly believe that ICAO is in the best position to immediately address this critical aviation safety issue. I stand firm in the belief that through collaboration and a common goal to achieve the highest possible safety levels, that the global aviation community can rise above the challenges we are currently facing, to the benefit of all humanity. I look forward to hearing from you soon.

Respectfully,



Capt. Joseph G. DePete
President
Air Line Pilots Association, International

cc: Captain Jack Netskar, President of IFALPA
cc: Mr. Juan Carlos Salazar, ICAO Secretary General Effective August 1, 2021
cc: Mr. Sean E. Doocey, U.S. Representative to ICAO