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Report to Congressional Requesters

August 2022

AVIATION SAFETY

FAA Should Strengthen Efforts to Address the Illegal Practice of Intentionally Aiming Lasers at Aircraft

Accessible Version

Reissued with revisions on August 26, 2022. Revised August 26, 2022, to correct the number of laser incidents reported in 2021 to 9,723 and the upper range of the civil penalties to $27,338 on the Highlights page.

GAO-22-104664

GAO Highlight

Highlights of GAO-22-104664, a report to congressional requesters

August 2022

AVIATION SAFETY

FAA Should Strengthen Efforts to Address the Illegal Practice of Intentionally Aiming Lasers at Aircraft

Why GAO Did This Study

FAA considers each laser incident an in-flight emergency, because of the potential for an accident and adverse effects of lasers on pilots. FAA data show the number of incidents in 2021 was the highest on record, with 9,723 incidents reported—an increase of about 42 percent from 2020.

GAO was asked to review federal efforts related to addressing laser incidents. This report examines, among other things: (1) the extent to which FAA and other agencies take action against those who point lasers at aircraft and challenges to investigations and reporting, and (2) public outreach efforts FAA and other agencies take to deter laser incidents.

GAO reviewed relevant statutes and regulations and assessed FAA's actions against GAO's work on managing for results. GAO analyzed FAA and Department of Justice data from July 2016 through September 2020 on enforcement actions and interviewed 15 aviation and local law enforcement entities to obtain a range of perspectives.

What GAO Recommends

GAO is recommending that FAA determine what information is most useful for investigating laser incidents and how best to collect and share it with law enforcement and that FAA routinely seek investigation and enforcement data from agencies for reporting to Congress; and explore re-establishing an interagency working group to collaborate on laser incident outreach. FAA concurred with these recommendations.

View GAO-22-104664. For more information, contact Heather Krause at (202) 512-2834 or krauseh@gao.gov.

What GAO Found

Aiming a laser at an aircraft can distract or disorient pilots and is a federal crime. The Federal Aviation Administration (FAA) investigates laser incidents, pursues civil penalties, and assists the Federal Bureau of Investigation (FBI) and U.S. Attorneys with investigations. Given the nature of laser incidents, FAA and federal law enforcement face difficulties identifying those involved. However, they have taken some enforcement actions, resulting in penalties ranging from $50 to $27,338 and sentences of up to 51 months, according to GAO analysis. To support incident investigations, FAA asks that pilots complete an incident questionnaire upon landing. However, FAA received responses for about 12 percent of the 8,221 laser incidents that occurred over a recent one-year period from 2020 to 2021. Reasons identified by FAA and others for the low response rate include the length of the questionnaire and its voluntary nature. Further, FAA does not consistently share collected information with law enforcement.

In 2016, Congress required FAA to report quarterly on laser incidents, including data on civil and criminal actions. However, GAO found FAA's reports to be incomplete. For example, GAO's analysis shows 44 prosecutions from July 2016 through September 2020, when FAA reported only four. FAA officials said they do not routinely request data on the status of actions from other agencies and face challenges, such as access to this data. By not routinely seeking updates from agencies, FAA does not provide Congress with a complete picture of laser incident investigations and enforcement actions as required.

Example of the Effects of a Laser Pointer Aimed at an Aircraft Cockpit

Source: Federal Aviation Administration and Federal Bureau of Investigation. | GAO-22-104664

FAA, FBI, and the Food and Drug Administration, which has regulatory authority over lasers, each conduct outreach to educate the public about laser incidents. These agencies were involved in an interagency group to address laser safety concerns until 2015 when the group dissolved. Since then, laser incidents have increased and identifying subjects remains difficult. FAA is well positioned to lead an interagency effort to explore re-establishing this group, given FAA's responsibility for the safety of the national airspace.

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Abbreviations

2016 Act	FAA Extension, Safety, and Security Act of 2016
ACI NA	Airports Council International North America
ALEAN	Airport Law Enforcement Agencies Network
AOPA	Aircraft Owners and Pilots Association
APSA	Airborne Public Safety Association
DOJ	Department of Justice
DHS	Department of Homeland Security
EOUSA	Executive Office for U.S. Attorneys
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FDA	Food and Drug Administration
HAI	Helicopters Association International
HHS	Health and Human Services
LASD	Los Angeles Sheriff's Department
LED	light emitting diodes
META	Meta Materials Inc.
NBAA	National Business Aviation Association
USAO	United States Attorney's Office

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U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

August 18, 2022

The Honorable Sam Graves
Ranking Member
Committee on Transportation and Infrastructure
House of Representatives

The Honorable Garret Graves
Ranking Member
Subcommittee on Aviation
Committee on Transportation and Infrastructure
House of Representatives

The misuse of handheld lasers, such as laser pointers, poses significant risks to aviation safety.[1] When aimed at an aircraft, the light beam can travel more than a mile to illuminate a cockpit. Some high-powered lasers can incapacitate pilots flying aircraft that may be carrying hundreds of passengers. The Federal Aviation Administration (FAA) considers each "illumination" of aircraft by lasers (laser incident) an in-flight emergency. Adverse effects of lasers include pain and visual effects, which can be especially debilitating when the eyes are adapted to the low-light level of a cockpit at night. Laser incidents can be especially dangerous during critical phases of flight, such as on approach to landing or departure, when sudden exposure to lasers can distract or disorient a pilot and cause temporary visual impairment. FAA has also identified helicopters (including police, air ambulance, military, and news media aircraft) that routinely operate at low altitudes as particularly vulnerable to hazardous laser strikes due to their proximity to laser sources.

The FAA Modernization and Reform Act of 2012 criminalized the intentional aiming of laser beams at aircraft, punishable by up to five years in prison, or a fine of up to $250,000, or both.[2] For civil penalties, the FAA Extension, Safety, and Security Act of 2016 (2016 Act) set a

[1]For the purposes of our report, the term laser refers to all lasers capable of projection into the navigable airspace, including laser pointers and laser light show projectors.

[2] Pub. L. No. 112-95, § 311, 126 Stat. 11, 65 (codified at 18 U.S.C. § 39A(a)). As a felony, the fine of up to $250,000 is established by 18 U.S.C. § 3571.

maximum penalty of $25,000 for an individual who aims the beam of a laser pointer at an aircraft, or at the flight path of such an aircraft.[3]

No known aircraft accidents have been attributed to laser illumination. However, given the sizeable number of incidents and debilitating effects that can accompany a laser incident, the potential for an accident exists, according to FAA. In February 2022, FAA stated pilots have reported 244 injuries attributed to lasers since it began recording data on laser incidents in 2010. FAA data show 9,723 laser incidents reported in 2021, the highest number since FAA began tracking this information.

In light of the persistence of laser incidents and their potential impacts on aviation safety, you asked us to report on enforcement actions, public education initiatives, and mitigation techniques related to laser incidents. Our report examines:

- the extent to which FAA and other federal agencies take enforcement action against those who point lasers at aircraft and challenges with investigations and reporting;
- public outreach efforts FAA and other federal agencies have taken to deter laser incidents, and what actions, if any, would strengthen these efforts; and
- options that stakeholders have identified to mitigate the effects of laser incidents, and the potential benefits and challenges to implementation.

To determine the extent to which enforcement actions are taken against those who point lasers at aircraft, we reviewed relevant statutes, regulations, and FAA documents related to reporting and investigating laser incidents and taking enforcement actions.[4] We analyzed FAA data on (1) the number of laser incidents; (2) FAA's enforcement actions, such as the number of orders assessing civil penalties;[5] and (3) quarterly reports that FAA is required to produce and submit to Congress on the

[3]Pub. L. No. 114-190, § 2104, 130 Stat. 615, 620. Previously, the maximum civil penalty was determined under FAA's general civil penalties authority at 49 U.S.C. § 46301, and according to FAA, could have been up to $11,000.

[4]Our review included the FAA Modernization and Reform Act of 2012, the 2016 Act, and 14 C.F.R. § 91.11.

[5]We analyzed data from July 2016 (when FAA began tracking actions) through September 2020.

numbers of laser incidents and on federal civil and criminal penalties, among other things.[6] We also analyzed data from the Executive Office for U.S. Attorneys (EOUSA) CaseView database from the same period to determine the number and magnitude of penalties, such as length of imprisonment. We performed a comparative analysis of FAA's quarterly reports to our analysis of both FAA's enforcement action data and EOUSA data. This analysis was performed to help determine whether FAA coordinates with federal law enforcement and reports information to Congress as required by the 2016 Act. We assessed the reliability of these data by reviewing documents, interviewing cognizant FAA and EOUSA officials, and conducting data tests to look for overlap and duplication. We determined the data were sufficiently reliable for our purposes of identifying trends in enforcement actions, determining the number and magnitude of penalties, and describing the limitations of enforcement data reported to Congress.

To determine the actions FAA and other federal agencies have taken to deter laser incidents, and what additional actions would strengthen these efforts, we reviewed documents on laser incidents to identify other federal agencies with roles in deterring laser incidents. Based on this review, we interviewed officials with the Federal Bureau of Investigation (FBI) and EOUSA within the Department of Justice; Food and Drug Administration (FDA) within the Department of Health and Human Services (HHS); and Department of Homeland Security (DHS) to determine if these agencies have a role in deterring laser incidents.[7] We reviewed FAA's and FDA's websites related to laser incidents and FBI's website on its 2014 reward program aimed at deterring laser strikes through public outreach and the apprehension of subjects involved in laser incidents. We also reviewed documents from an interagency laser strike-working group established in 2010 and active until 2015 that focused, in part on educating the public and aviation community on the hazards, effects, and consequences of aiming a laser at an aircraft.

[6]Section 2 of the 2016 Act specifies the committees of Congress to which FAA is to provide these reports. These committees are the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives.

[7]Based on these interviews, we determined that FBI has a role in federal law enforcement actions and FDA has a role, since the agency has authority to regulate all kinds of lasers. DHS officials told us they have no role in investigating or deterring laser incidents, and based on this, we did not include them in our evaluation.

To determine the options stakeholders have identified to mitigate the effects of laser incidents and the potential benefits and challenges to implementation, we reviewed documents including guidance, manuals, and presentations related to laser mitigation efforts, such as the International Civil Aviation Organization Manual on Lasers and Flight Safety. We also reviewed FAA documents on laser incident mitigation technologies, such as laser eye protection.

To inform all three objectives, we interviewed officials from FAA, FBI, EOUSA, and FDA. We conducted semi-structured interviews with representatives from a non-generalizable sample of 15 aviation stakeholders, local law enforcement agencies, and stakeholders from organizations developing mitigation strategies and recommendations to address laser incidents, and mitigation strategies. Because we selected a non-generalizable sample of stakeholders, their responses should not be used to make inferences about a population. To characterize stakeholders' views in some cases, we defined modifiers (e.g., "several") to quantify stakeholders as follows:

- "several" stakeholders represents stakeholders in 3 to 5 of the interviews,
- "some" stakeholders represents stakeholders in 6 to 10 of the interviews, and
- "most" stakeholders represents stakeholders in 11 or more of the interviews.

For more information on our scope and methodology, see appendix I.

We conducted this performance audit from November 2020 to August 2022, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The use of lasers has grown rapidly in recent years, where they are often used to attract and entertain the public with productions at special events, theme parks, and casinos.[8] They can be used as pointers to highlight areas of interest while conducting presentations, and in sighting handguns and rifles, among other things.[9] Lasers can be beneficial and can improve the quality, precision, accuracy, security and reliability of many forms of products, materials, communications and data handling. Lasers have become less expensive and more available to the general public.

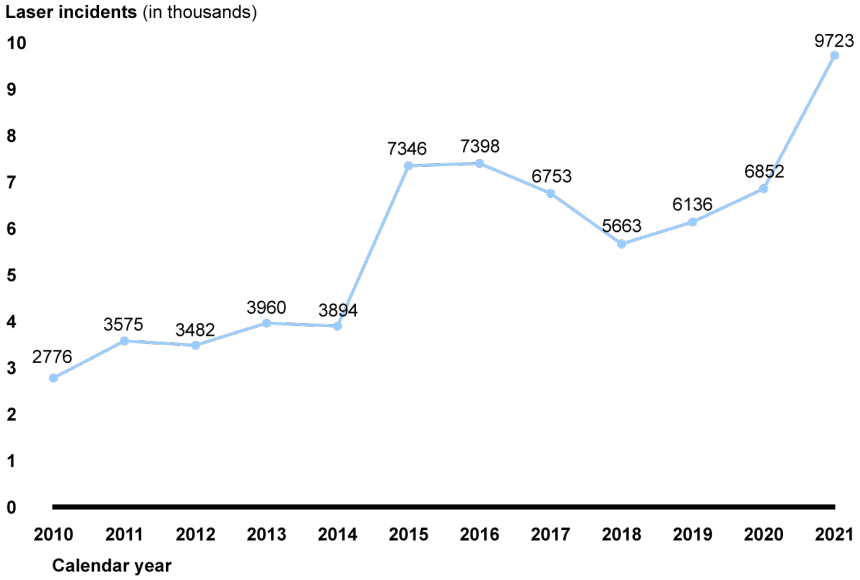
Lasers and Aviation Safety

FAA's data show the number of reported laser incidents is increasing. In particular, the number of incidents reported in 2021 (9,723) was the highest on record, representing an increase of about 42 percent from 2020, and an increase of about 31 percent from 2016—the previous peak (see fig. 1). The most current data available for 2022 show laser incidents continuing to trend at a high rate with 3,651 incidents as of May 31, 2022.

[8]Laser stands for light amplification by the stimulated emission of radiation. One basic type of laser consists of a sealed tube containing a pair of mirrors and a laser medium that is excited by some form of energy to produce either visible light or invisible ultraviolet or infrared radiation.

[9]The FAA Modernization and Reform Act of 2012 defines a laser pointer as any device designed or used to amplify electromagnetic radiation by stimulated emission that emits a beam designed to be used by the operator as a pointer or highlighter to indicate, mark, or identify a specific position, place, item, or object.

Figure 1: Laser Incidents Reported to Federal Aviation Administration by Pilots and Crewmembers, Calendar Years 2010 through 2021



Source: Federal Aviation Administration data. | GAO-22-104664

Accessible Data Table for Figure 1

Year	Laser incidents (in thousands)
2010	2.776
2011	3.575
2012	3.482
2013	3.96
2014	3.894
2015	7.346
2016	7.398
2017	6.753
2018	5.663
2019	6.136
2020	6.852
2021	9.723

FAA officials and representatives from aviation stakeholder groups suggested several factors could have contributed to the increase. These potential factors include the availability of cheap lasers, the abundance of lasers for sale in stores and online, and the increase in laser pointers that are more powerful and can strike aircraft at higher altitudes.

Although the number of reported laser incidents affects a small percentage of the millions of flights in the U.S. airspace annually, lasers can harm a pilot's vision and laser incidents are potentially dangerous. According to a report from FAA's Civil Aerospace Medical Institute, aircraft conducting low-level flight operations at night can be particularly vulnerable to accidental or malicious laser incidents that can compromise aviation safety.[10] The report notes that pilots receive approximately 90 percent of information needed to safely fly an aircraft through the sense of vision. Pilots need good vision at far distances to "see-and-avoid" other aircraft while in flight and objects on the runway or taxi lanes, at intermediate distances to see the instrument panel, and at near distances to see maps, charts, and flight manifests. The report further notes that during critical phases of flight if a pilot does not have adequate time to recover after a laser incident, the consequences could be tragic. Another report from FAA's Civil Aerospace Medical Institute found even momentary exposure from a laser pointer can cause discomfort and temporary visual impairment including glare, flash blindness, and afterimages, without causing permanent physical damage.[11] Figure 2 shows an example of the effects of a laser pointer when aimed at an aircraft cockpit.

[10]FAA, Civil Aerospace Medical Institute, *The Effects of Laser Illumination on Operational and Visual Performance of Pilots Conducting Terminal Operations,* (Washington, D.C. August 2003).

[11]FAA, Civil Aerospace Medical Institute, *Laser Pointers: Their Potential Affects (sic) on Vision and Aviation Safety*(Washington, D.C.: April 2001). According to FAA *glare* is the dazzling sensation induced by a relatively bright light, which produces unpleasantness, discomfort, or interferes with optimal vision; *flash blindness* is defined as visual loss during and following exposure to a light flash of extremely high intensity; and *afterimage* is a persisting sensation or image perceived after the correlated physical stimulus has been removed.

Figure 2: Example of the Effects of a Laser Pointer Aimed at an Aircraft Cockpit

Source: Federal Aviation Administration and Federal Bureau of Investigation. | GAO-22-104664

According to an FAA report, the color of a laser beam is directly related to its wavelength and its sensitivity to the human eye.[12] The report notes that if two laser pointers are of equal power but different wavelengths, one may appear brighter than the other. This is due to the human eye's inherent sensitivity to some wavelengths. Most laser pointers are red or red-orange in color. Green laser pointers are relatively new devices and are considerably more expensive than a red laser pointer. Compared to red light, human vision is highly sensitive to green light and much more sensitive to green and blue light at night. According to FAA's publication on laser hazards, over 90 percent of all aircraft illuminations by handheld lasers are green in color, followed by red with the remainder being other colors or combinations of colors.

FDA issued a Consumer Safety Alert in 2019 notifying the public about lasers being sold on the internet that posed a risk if directed at aircraft. It noted a particular concern about the increased availability of overpowered green, blue and violet laser pointers, stating these may have been modified to emit more radiation than the manufacturer's original product.[13] FDA officials stated that overpowered laser pointers are those whose design and emissions do not comply with FDA performance standards

[12]FAA, Civil Aerospace Medical Institute, *Laser Pointers: Their Potential Affects (sic) on Vision and Aviation Safety* (Washington, D.C.: April 2001).

[13]FDA. *Consumer Safety Alert: Internet Sales of Laser Products.* (June 13, 2019).

due to excessive power or lack of safety features or may have been modified to emit more radiation than the manufacturer's original product.

Authorities Related to Lasers

Multiple laws, including a federal criminal law, prohibit aiming a laser at an aircraft. FAA, the Department of Justice, and states have the ability to take actions depending on the circumstances, their authorities, and evidence in a laser incident.

FAA: FAA's regulations prohibit a person from interfering with a crewmember in the performance of the crewmember's duties aboard the aircraft being operated.[14] FAA considers a situation in which a laser beam is aimed at an aircraft so that it interferes with a crewmember's duties as a violation of this regulation.[15] In particular, it has authority to take action if the individual carelessly, recklessly, or intentionally violated its regulation.[16] These actions include civil legal enforcement actions (e.g., ordering civil penalties); administrative actions (e.g., issuing warning notices to subjects); and compliance actions (e.g., ordering counseling) for laser incidents directed at aircraft.[17] FAA also assists federal, state and local law enforcement agencies to pursue criminal penalties under their authorities against those individuals (subjects) who aim a laser at an aircraft.[18]

[14] 14 C.F.R. § 91.11. FAA has broad authority to take actions necessary to ensure safety in air commerce and transportation. 49 U.S.C. §§ 44701, 40113, 46301. A *crewmember* is defined as a person assigned to perform duty in an aircraft during flight time. 14 C.F.R. § 1.1.

[15] 76 Fed. Reg. 76611 (Dec. 8, 2011).

[16] FAA Order 2150.3C, FAA Compliance and Enforcement Program (FAA 2021). In order to take action, FAA's authorities related to laser incidents allow FAA to (1) meet a lower burden of proof and (2) prove that the subject had a lesser knowledge of wrongdoing than the criminal statute related to laser incidents. For legal enforcement actions with civil penalties, FAA must prove that an individual violated the regulation by a preponderance of evidence (more likely than not). 14 C.F.R. § 13.223; Stryde, Docket No. FAA-2017-1225 (Dec. 9, 2019).

[17] According to FAA officials, FAA may also revoke a pilot certificate if the violator held one.

[18] For the purposes of this report, individuals identified, suspected, convicted, etc. are referred to as subjects.

Department of Justice (DOJ): A federal statute criminalizes when an individual knowingly aims a laser at an aircraft[19] or in the flight path of an aircraft.[20] These crimes are investigated by FBI and prosecuted by the United States Attorney's Office (USAO), both part of DOJ. The DOJ can pursue criminal penalties, including imprisonment and fines. For these criminal cases, the government must prove beyond a reasonable doubt that the individual committed the crime, which is a higher standard than FAA must prove in its legal enforcement actions.

States: States have also established criminal offenses for aiming lasers at aircraft, and these offenses vary by state. If a state has established an offense applicable to the specifics of the laser incident, states can pursue criminal penalties, such as imprisonment and fines. The statutes we reviewed generally require the perpetrator to have knowingly, intentionally, or willfully aimed the laser at an aircraft. Additionally, where the laser beam is aimed in relation to the aircraft or aircraft operator could affect a state's ability to bring a criminal charge.[21]

FDA: In addition, FDA has a role in ensuring the safety of lasers. The Federal Food, Drug, and Cosmetic Act, as amended, grants FDA authority to regulate both medical and nonmedical lasers. Such lasers include laser pointers, those lasers used to solder circuits in factories, lasers that scan groceries in a supermarket, and lasers used to entertain a crowd with a light show in the night sky.[22] FDA requires manufacturers to, among other things, classify laser products into one of four major hazard categories (the higher the class the more powerful the laser); certify conformance with all applicable standards for electronic products

[19]The aircraft must be in the special aircraft jurisdiction of the United States, which includes an aircraft in the United States and certain aircraft outside the United States such as a civil aircraft of the United States or an aircraft of the United States armed forces. 18 U.S.C. §§ 31(b), 39A, 49 U.S.C. § 45601(2).

[20]18 U.S.C. § 39A.

[21]For example, (1) provisions may specify that an individual must aim the laser at the aircraft, s*ee, e.g.,* Cal. Penal Code § 247.5; Del. Code Ann. tit. 2, § 312(a); (2) create visible light in the cockpit, s*ee, e.g.,* 720 Ill. Comp. Stat. Ann. 5/26-7(b)(2); Minn. Stat. Ann. § 609.857; Ohio Rev. Code Ann. § 2909.081; or (3) aim the laser at the individual operating the aircraft, s*ee, e.g.,* Fla. Stat. Ann. § 784.062(3); Md. Code Ann., Crim. Law § 3-807(c); versus the aircraft generally. In addition like the federal criminal offense, some statutes include aiming the laser in the aircraft's flight path, s*ee, e.g.,* Ga. Code Ann. § 16-11-45(b); La. Rev. Stat. Ann. § 14:336(A).

[22]21 U.S.C. §§ 360hh, 360ii.

by means of product label;[23] and submit a report demonstrating that applicable mandatory radiation safety-performance standards are met. See appendix II for FDA classes of lasers, potential hazards, and examples of different products in those classes.

Investigating Laser Incidents

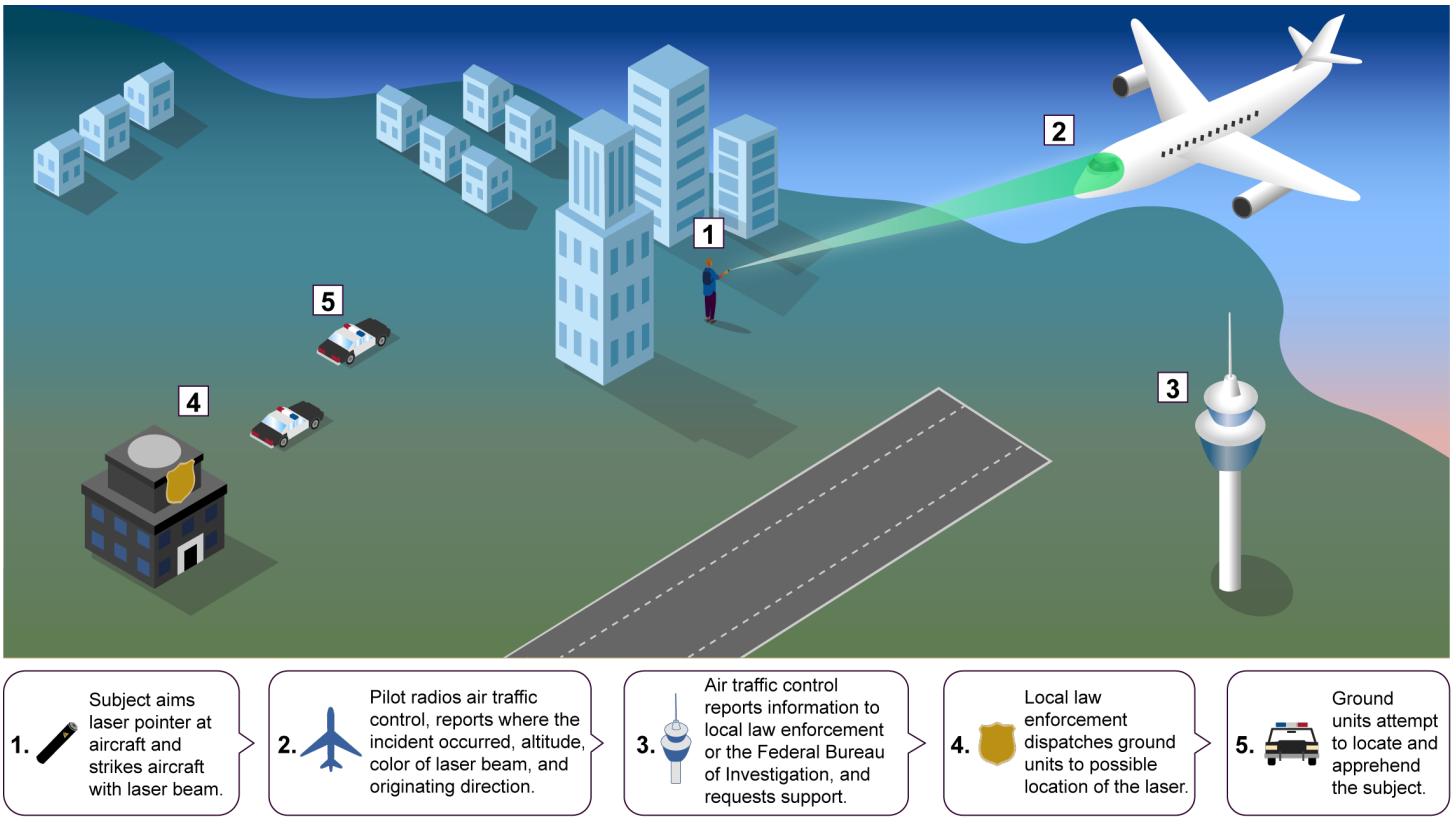
FAA generally relies on local law enforcement to conduct the initial investigation and identify the subject. FAA's policy on reporting and investigating laser incidents states that FAA is to work with law enforcement to identify a subject and obtain any additional information that may be needed to support a civil investigation.[24] According to its guidance to law enforcement agencies, FAA recognizes that state and local law enforcement agencies are often in the best position to deter, detect, and immediately investigate laser incidents.[25] The guidance also states that local law enforcement can provide invaluable assistance to FAA by identifying and interviewing potential witnesses, identifying the subject suspected of lasing an aircraft, and identifying and collecting evidence such as video or other visual evidence of the laser incident. See figure 3 for an example of the process for reporting and responding to a laser incident.

[23]The labeling for Classes II–IV must include a warning symbol that contains specific information, including the class and the output power of the product. Class I lasers are not considered hazardous and require no special labeling.

[24]FAA, Flight Standards Information System, *Unauthorized Laser Illumination Incident Reporting and Civil Investigation Process* 8900.1 CHG 549.

[25]FAA, *Law Enforcement Guidance for Identifying and Reporting Unauthorized Laser Illumination Incidents Against Aircraft*, (Mar. 1, 2022).

Figure 3: Example of Laser-Incident-Reporting and Response Process



Source: GAO analysis of Federal Aviation Administration information. | GAO-22-104664

Depending on the available resources, several stakeholders explained local law enforcement may take different steps to attempt to identify a subject. For example, local law enforcement can dispatch a ground unit to an area to identify a subject, or it may dispatch an aircraft—such as a helicopter—to the area to attempt to locate a subject or to act as bait in hopes of being lased. If a law enforcement aircraft is lased, law enforcement may then dispatch ground units to try to identify the subject while the aircraft tracks the subject's location.

If a subject is identified, FAA puts together an investigative package. This package can contain evidence based on interviews with law enforcement, police records, navigational data from air traffic control and pilot reports, and other information needed for FAA to pursue civil prosecution or other action within its jurisdiction.

In addition, the FBI investigates laser incidents where evidence suggests the lasing was intentional. The USAO prosecutes and supports investigations of federal criminal violations, including laser incident related crimes.[26] While FBI refers most of the laser incidents that USAOs considered, the Departments of Transportation, Homeland Security and others also make referrals to USAOs. According to FBI officials, they work closely with the USAO while investigating laser incidents to determine if federal prosecution is warranted and to increase the likelihood the USAO has enough evidence for a viable prosecution. FBI officials noted they work with local law enforcement to determine if a laser incident should be prosecuted locally (if state or local laws prohibit lasing aircraft) or federally.

FAA and Federal Law Enforcement Take Enforcement Actions, but Challenges with Investigations and Data Reporting Persist

Enforcement Actions Include Civil Penalties and Terms of Imprisonment

Our analysis of FAA data, from July 2016 through September 2020, found FAA took action against 99 of the 232 subjects identified in laser incidents.[27] Specifically, FAA:

[26]As discussed previously, the FAA Modernization and Reform Act of 2012 criminalized the intentional aiming of laser beams at aircraft.

[27]In some instances, there were multiple subjects identified in a single laser incident and not all subjects may share the same outcome. Additionally, FAA's internal data do not always specify the number of subjects involved with a laser incident. For the purposes of our analysis, we consider incidents with an unknown number of subjects as having one subject.

- Assessed civil penalties against 70 of the 99 subjects.[28] These civil penalties, ranged from $50 to $27,338.[29]
- Proposed but had not assessed civil penalties against 17 of the 99 subjects.[30]
- Ordered administrative actions (e.g. issuing warning notices to subjects) against three subjects
- Issued compliance actions (e.g. counseling) against eight subjects.
- Referred one case to the government of Canada for legal action because the subject was a Canadian resident.

At the time of our analysis, FAA had not taken actions against 133 of the 232 subjects identified. For 28 of these subjects, the cases are still pending review by FAA while the remaining cases are no longer active for reasons outlined in table 1.

[28]If FAA pursues a civil penalty action for an apparent laser violation, FAA first issues a notice of proposed civil penalty. The subject has the right to, among other options, request an informal conference to discuss the matter or request a hearing in response to the notice. If a subject fails to respond to the notice or the matter is not resolved through an informal conference, then FAA may issue a final notice of proposed civil penalty, from which the subject may also request a hearing. FAA issues an order assessing a civil penalty when the person agrees to pay the civil penalty, the person does not request a hearing after a final notice of civil penalty, an FAA decision maker issues a decision on appeal, or an administrative law judge decides that matter, and the decision is not appealed. issues a civil penalty. 14 C.F.R. §§ 13.16, 13.202.

[29]In accordance with Department of Transportation's adjustment of civil penalties for inflation, as of May 2021 FAA could order civil penalties up to $26,929 for each laser incident. 86 Fed. Reg. 23241 (May 3, 2021). Each incident is subject to the statutory limit of civil penalties adjusted by inflation. Therefore, if a subject is involved in multiple laser incidents, as outlined in FAA's compliance and enforcement program guidance, FAA can impose a civil penalty for each violation, and that total penalty may be higher than a single penalty that is at the maximum amount. The regulations and guidance also allow FAA to reduce a penalty amount in a civil action, if it receives financial information related to a subject's ability to pay. 14 C.F.R. § 13.16, FAA Order 2150.3C.

[30]According to FAA officials, some of these cases may be pending before DOT Administrative Law Judges, and FAA has no control over how long a case is pending. For example, in one case where a violation occurred in June 2012, a hearing occurred in December 2014, but the Administrative Law Judge did not issue an order until December 2020. *In the Matter of Pennywitt*, FAA Order No. 2021-01 (Jul. 15, 2021).

Table 1: Number of Subjects and Reasons Federal Aviation Administration Had Not Taken Action against Subjects Involved in Laser Incidents, Fourth Quarter Fiscal Year 2016 to Fourth Quarter Fiscal Year 2020

Number of subjects	Reason no action taken
28	Pending. Cases are still open. According to FAA officials, FAA could be in the process of taking enforcement or compliance actions against the subjects involved.
37	Insufficient evidence. FAA lacked evidence to proceed with investigation.
17	Stale. According to FAA's guidance, if no action is taken within 24 months FAA considers the case to be "stale" and FAA closes the case without taking action.[a]
17	Miscellaneous reasons. Includes FAA being unable to locate a subject and the subject's being a minor.[b]
34	No explanation provided
133	**Total Number of Subjects**

Source: GAO analysis of FAA internal data on laser incidents. | GAO-22-104664

[a]Under FAA regulations, a subject may request dismissal of a complaint when a violation occurred more than 2 years before an agency issued a notice of proposed civil penalty. 14 C.F.R. § 13.208(d)

[b]According to FAA officials, FAA's policy is to take enforcement action against a minor; however, according to FAA data, FAA did not take action in 2 of cases because the subject was a minor.

FAA's compliance and enforcement program policy calls for it to pursue enforcement actions if conduct is reckless or intentional.[31] FAA officials told us a laser incident is considered reckless or intentional if, among other things, a subject repeatedly lases the same aircraft. For example, the officials noted there was a case where a subject lased a law enforcement helicopter and law enforcement had a video recording of a subject lasing, running, and lasing the helicopter again. If a subject's actions are not reckless or intentional, FAA officials told us they consider what action to take regarding laser incidents on a case-by-case basis and can pursue an administrative or compliance action.

According to our analysis, the FBI and other federal entities referred 86 laser incidents to USAOs for prosecution from July 2016 through September.[32] Our analysis shows USAOs prosecuted 44 subjects, resulting in 40 convictions. In 23 of the 40 convictions, the subject

[31]FAA Order 2150.3C. FAA defines intentional conduct as a deliberate act (or failure to act) while knowing that such conduct is contrary to a regulation or statute, or is otherwise prohibited. Reckless conduct is defined as an act (or failure to act) demonstrating a gross disregard for or deliberate indifference to safety or safety standard.

[32]Because we relied on both EOUSA data and court dockets to identify the status of enforcement actions, some of our information may be more current than EOUSA data.

received no term of imprisonment, while 15 subjects were sentenced to terms of imprisonment ranging from 3 months to 51 months. FBI officials told us federal prosecution may be more likely if a subject is suspected in a cluster of laser incidents, if a law enforcement aircraft was lased and a mission was interrupted, or if a subject had prior offenses, among other criteria.

Challenges May Impede Laser Incident Investigations and Reporting

While FAA and others have taken action against identified subjects, further actions to address laser incidents are limited by several challenges. FAA and law enforcement face difficulties identifying subjects and subjects are identified in about 1 percent of the laser incidents reported to FAA. FAA requests pilots and crewmembers provide the agency with information on the incident to help with law enforcement efforts, but it usually does not receive responses to these requests. When FAA does receive this information, the agency does not regularly share these details with law enforcement. Further, the law requires FAA provide Congress quarterly updates that include enforcement actions, but FAA's reports are incomplete.

Identifying Subjects is Difficult

Identifying a subject or subjects involved in a laser incident is difficult. According to our analysis of FAA data, pilots and crewmembers reported 27,000 laser incidents to FAA from July 2016 through September 2020, and as previously stated, only 232 subjects were identified. FAA, FBI, and several local law enforcement officials we spoke with told us identifying the subject is the most difficult part of a laser incident investigation. For example, an official with the Phoenix Police Department told us identifying a subject is difficult because of the nature of laser incidents—they almost always happen at night, lasers are small and can be easily hidden, and laser beams can travel long distances so the search area is often very large.

According to FAA's guidance to law enforcement agencies, the overwhelming majority of laser incidents where subjects were identified involve illumination of police or media aircraft.[33] Local law enforcement

[33]FAA, *Law Enforcement Guidance for Identifying and Reporting Unauthorized Laser Illumination Incidents Against Aircraft*, (Mar. 1, 2022).

officials told us one reason for this is that helicopters can hover over an area where a subject is lasing aircraft and video record the incident until law enforcement ground units arrive.

FAA Requests Pilots and Crewmembers Provide Incident Information, but Responses Usually Not Received

To support law enforcement efforts to identify and apprehend subjects, FAA requests pilots and crewmembers involved in laser incidents provide information on the incident upon arrival at their destination.[34] FAA collects this information through the voluntary FAA Laser Beam Exposure Questionnaire, which, among other things, asks for:

- estimated geographic location of the laser;
- phase of flight when the laser incident occurred;
- physical effects of the lasing, whether the laser shone directly into one or both eyes, vision effects, and post-lasing eye exam results;
- type of operation (commercial, military, law enforcement, medical, news reporting, general aviation);
- effect on the flight, whether the incident interfered with the performance of pilot or crew, caused a change in flight path, and for law enforcement, military, or medical flights, disrupted the mission; and
- whether the laser appeared to deliberately track the aircraft.

FAA provides pilots and crewmembers an option to download and complete the Laser Beam Exposure Questionnaire and e-mail or fax it to FAA or to complete a mobile questionnaire. Appendix III shows the FAA Laser Beam Exposure Questionnaire. FAA officials said while they primarily focus on the real-time or near real-time pilot reports of laser incidents to air traffic control for their investigations, they use the information collected from the completed questionnaires to correlate air traffic information and supplement other information collected for investigations.

According to FAA officials, they rarely receive completed questionnaires. Specifically, from June 2020 to May 2021, we determined that 8,221 laser

[34]As previously noted, pilots and crewmembers are requested to immediately report incidents of unauthorized laser illumination by radio to the appropriate FAA air traffic control facility.

incidents were reported to FAA. For that same time period, FAA stated it received 956 completed questionnaires, or about 12 percent of the number of incidents.

FAA officials and representatives from a pilot's group identified a variety of reasons for the low response rate. For example, FAA officials attributed the low response rate to the voluntary nature of completing the questionnaire. These officials also said pilots may not believe that the time it takes to complete the form is worthwhile; meaning pilots may believe the report is unlikely to result in identification of a subject and subsequent legal action. Representatives from one pilots' group told us the number of completed questionnaires is likely due to the length of the form and the circumstances surrounding the laser incident. Specifically, the representatives said the questionnaire is 5 pages, which is not a realistic length for a pilot and crew to have the time to complete since they are either preparing for the next flight or heading for crew rest or home once they land. Additionally, the representatives noted that many laser incidents happen during takeoff, approach, and landing, when the crew is at their busiest and may not have the time to annotate detailed location information to use later for filing.

While FAA states the information collected from completed questionnaires is to support law enforcement efforts, the agency does not consistently share that information with local law enforcement. FAA officials told us they provide information to local law enforcement on an ad-hoc basis and generally only when local law enforcement requests the information.

Selected local law enforcement entities we spoke with said information FAA requests in the questionnaire, such as the approximate location of the laser and whether the laser beam appeared to deliberately track the aircraft, would be helpful to their investigations. One local law enforcement official told us that planes landing at Los Angeles International Airport approach from the east and fly over several policing jurisdictions before landing. The official added that a summary of the information requested in the questionnaire would be helpful in establishing the elements of the crime for a successful prosecution. Additionally, a representative of an organization representing airport law-enforcement agencies told us that any additional information FAA could provide on laser incidents would be helpful for investigating repeat incidents. The representative also recommended FAA forward any information gathered via the questionnaire to the investigating police agency.

Although information from the questionnaire has potential to support law enforcement, FAA has not assessed what information might be most useful for identifying subjects and supporting investigations. Determining the most useful information could help FAA make informed decisions about collecting information and sharing the information with law enforcement to support investigations. FAA's guidance to pilots and crewmembers on reporting laser incidents states that following an incident pilots should provide FAA with as much information as available and notes expeditious reporting will assist law enforcement in locating the source of the laser.[35] FAA officials said there are ongoing discussions about the potential value added in increasing the number of pilot responses to the questionnaire. However, FAA has not evaluated ways to increase the response rate or what data from those questionnaires might be most useful for investigations.

Until FAA determines what information from pilots and crewmembers would be most useful for investigating laser events and how best to collect this information and share it with law enforcement, FAA is less equipped to improve the value added of the questionnaire or evaluate another means of collecting information, moving forward. Determining what information is needed would also better position FAA to explain how the data collected are useful in investigations and therefore could also improve pilots' underlying sentiment about completing the questionnaire. Further, FAA's efforts might help refine the number of data elements collected from pilots, potentially improving pilot response rate by streamlining the form.

FAA Provides Congress with Incomplete Information on Laser Incidents

The 2016 Act requires FAA to coordinate with appropriate federal law enforcement agencies and to provide Congress with quarterly updates for laser cases.[36] Specifically, these updates must include data on:

[35]FAA, AC-70-2B, *Reporting Laser Illumination of Aircraft*, (April 3, 2020).

[36]Section 2 of the 2016 Act specifies the committees of Congress to which FAA is to provide these reports. These committees are the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives. FAA officials told us that they do not update the report on a rolling basis, and some updates may not be captured until the following quarter.

- the number of civil or criminal enforcement actions taken by FAA, the Department of Transportation, or another federal agency with regard to laser-pointing in incidents, including the amount of civil and criminal penalties imposed on violators, and
- the resolution of any laser incidents described that did not result in a civil or criminal enforcement action.[37]

Our analysis shows FAA's reports on laser incidents do not include all federal criminal enforcement actions, as required by the 2016 Act.

- Investigations are a precursor to law enforcement's taking criminal enforcement actions, and FAA reports investigations in its quarterly reports. FAA reported FBI involvement with investigating 13 laser incidents from July 2016 through September 2020. Our analysis of USAO data showed that FBI investigated 58 laser incidents and referred the matters to the USAO for consideration, during this same period.[38]
- FAA reported 4 laser incidents as referred for prosecution or handled in the courts. Our analysis also showed USAOs prosecuting 44 subjects. Additionally FAA reported incomplete information on 3 of those 4 laser incidents that were identified as being filed in the courts.[39] Specifically, FAA reported:
  - One incident as *case handled in district court*, but did not include details on the criminal penalty. USAO's case management data show that the subject pled guilty and the subject's sentence did not include a term of imprisonment.
  - One incident, reported as *FBI involved and prosecution pending,* did not include details on the criminal penalty. USAO's case management data show the subject pled guilty and the subject's sentence was 18 months of imprisonment.
  - One incident with two subjects was reported as *convicted in US District Court*, but did not include details on the criminal penalty. Court records show one subject sentenced to home detention for

[37]Pub. L. No. 114-190, § 2104, 130 Stat. at 620.

[38]To determine the number of laser incidents FBI investigated, we analyzed USAO enforcement action data and calculated the number of incidents FBI referred to USAO as matters beginning in July 2016.

[39]Our analysis shows FAA reported one incident as *forwarded to US Attorney*, but we were unable to match the subject's name from FAA's internal data on laser incidents.

12 months, and the other subject sentenced to 36 months of probation.

FAA faces challenges collecting laser incident information and reporting it to Congress. FAA officials told us they collect information on laser incidents and investigations from its officials at the local level. If they become aware of a criminal prosecution, the officials said they will pursue additional information on the case from the other federal agencies, but officials stated that FAA does not have access to FBI or USAO data and they have not been able to obtain information on certain individual laser cases. They also said that there is no requirement for the FBI, USAO, or other federal agency to update FAA on the status of cases or provide it with laser case documentation. However, FAA does not, on a routine basis, seek updates from agencies or explain that the purpose of such outreach would be to fulfill its responsibilities under the 2016 Act.

While FAA officials explained the challenge in obtaining this information to us, FAA has not reported limitations in data or challenges it faces in fulfilling the requirements of the 2016 Act. As a result, FAA does not provide Congress with a complete picture of laser incident investigations and enforcement actions or explain where gaps in information might exist. *Standards for Internal Control in the Federal Government* state agencies should use quality information to achieve objectives.[40] Among other things, quality information should be complete and accurate

Without complete information, decision makers, including Congress, may face challenges in assessing the government's efforts to deter and mitigate laser incidents. Additionally, without this information, FAA may be limited in its ability to effectively evaluate the results of its own enforcement efforts and make adjustments as needed.

FAA, FBI, and FDA Each Conduct Public Outreach, but No Longer Have a Collaboration Mechanism

FAA, FBI, and FDA officials told us they primarily conduct outreach to educate the public about the dangers and illegality of aiming lasers at aircraft. This outreach uses avenues such as websites, news stories on

[40]GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: September 2014).

laser incidents, and social media. Some stakeholders told us educating the public about these dangers and the penalties for intentionally aiming a laser at an aircraft was key to deterrence. FAA, FBI, FDA, and other federal agencies previously participated in an interagency laser incident-working group that educated the public about the hazards, effects, and consequences of aiming lasers at aircraft. However, this group no longer exists because FAA decided to dissolve the working group.

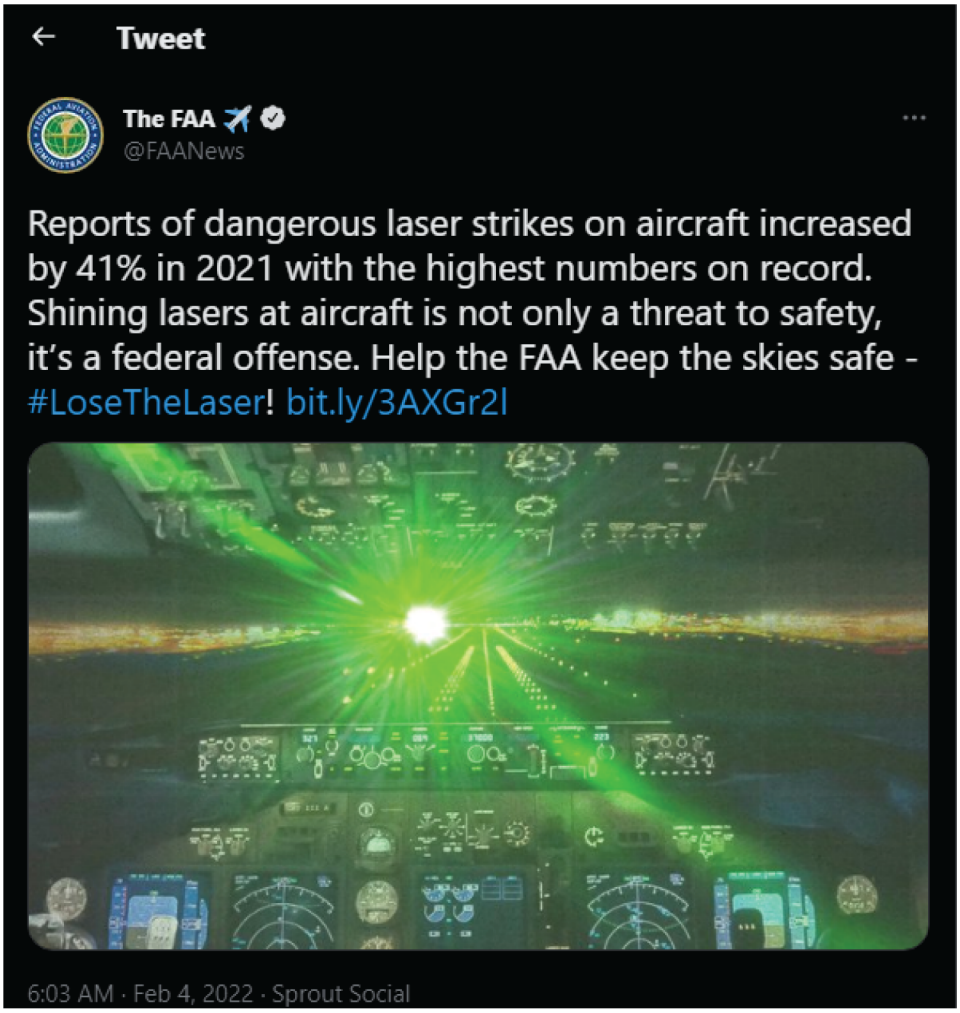
FAA Outreach Includes Its Website, Social Media, and Media Outlets

FAA's public outreach to deter laser incidents against aircraft includes using its laser safety website, its social media accounts, and various media outlets.

- **Laser Safety Website.** FAA's Laser Safety website explains that aiming a laser at an aircraft is a serious safety risk and violates federal law, because lasers can incapacitate pilots who are trying to fly safely to their destinations while possibly carrying hundreds of passengers. The website also includes information on how to report a laser incident, as well as FAA procedures and guidelines when planning an outdoor laser light show or demonstration to ensure the safety of pilots and crew. Additionally, FAA established website links to FBI, FDA, the Air Line Pilots Association, the Transportation Security Administration, the National School Resource Officer Organization,[41] and other sources with information on laser awareness.
- **Social media.** FAA uses its various social media platforms (e.g., Twitter, Facebook, Instagram, and LinkedIn) to post information regarding laser incidents, including the dangers of inappropriate laser usage. Between December 2017 and October 2021, FAA reported it posted information about laser incidents 187 times across the various platforms. See figure 4 for an example of an FAA Twitter post.

[41]FAA officials told us that the agency has conducted outreach at schools to target teenagers' use of lasers and the dangers of pointing lasers at aircraft.

Figure 4: Federal Aviation Administration's Twitter Post on the Dangers of Pointing Lasers at Aircrafts



Source: GAO analysis of laser incidents on the Federal Aviation Administration Twitter account. | GAO-22-104664

- **Media outlets.** FAA officials said they proactively reach out to the media about the dangers of aviation-related laser incidents and seek local, regional, and national media coverage of laser incidents. For example, in August 2021, FAA contacted NBC News about the increase in laser incidents and provided them with current data. NBC News then ran a national news segment regarding the increase in

laser incidents, the hazards involved, and relevant penalties.[42] FAA officials told us this news segment led to local coverage, when local news stations used this segment to report on the number of incidents happening in their area.

To support outreach efforts, FAA also uses laser incident data to identify localized increases in the number of laser incidents, which it refers to as a clusters. Once a cluster is identified, FAA officials said they would use the information to focus outreach efforts and engage with the public in that area about the dangers of laser incidents. FAA law enforcement guidance also encourages local law enforcement to participate in outreach activities. For example, according to FAA officials, in 2015 there was what officials termed “a huge uptick” in laser incidents in the Huntsville, Alabama area. An FAA official, along with local law enforcement officials, went to several subdivisions, passed out brochures and talked to residents at their homes and in public areas about the dangers and illegality of pointing lasers at aircraft. The officials said that, while no subject was identified, the laser incidents immediately decreased.

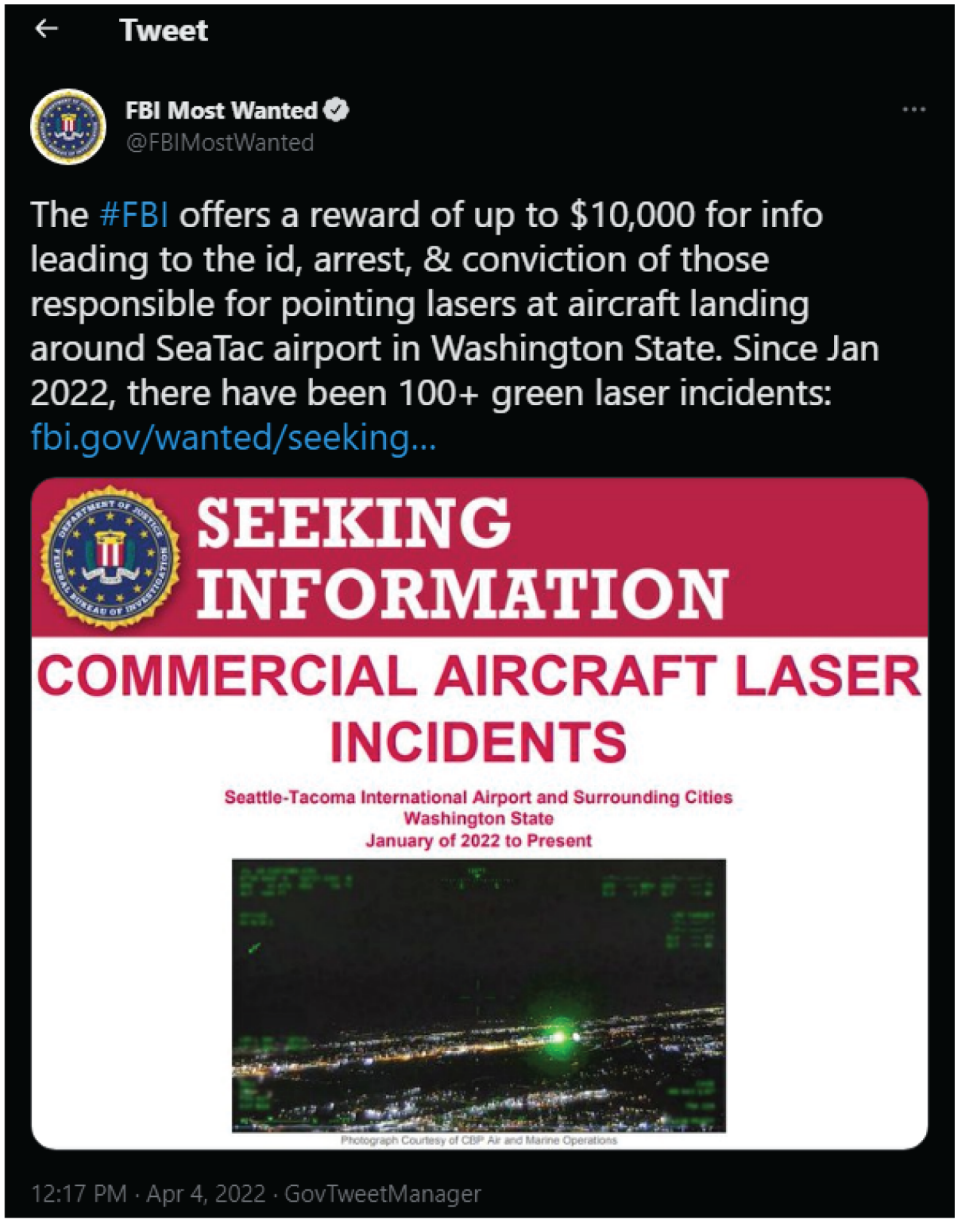
FBI Outreach Includes Social Media and Rewards

FBI uses social media to offer rewards in identifying subjects and inform the public about the hazards and illegality of pointing a laser at aircraft.

- **Social Media.** FBI uses its social media accounts to educate the public that pointing lasers at aircraft poses a safety threat to pilots and violates federal law, and to obtain information from the public about laser incidents. See figure 5 for an FBI Twitter post.

[42]NBC News, “Laser strikes on planes nearing record level” (Aug. 31, 2021), accessed August 15, 2022, https://www.nbcnews.com/nightly-news/video/pilots-reported-record-number-of-laser-attacks-in-2020-119905861724

Figure 5: Federal Bureau of Investigation (FBI) Twitter Post Seeking Information on Laser Incidents



Source: GAO analysis of laser incidents on the Federal Bureau of Investigation Twitter account. | GAO-22-104664

- **FBI rewards.** FBI uses rewards for information as part of its outreach related to laser incidents. In 2014, FBI established a targeted reward program aimed at helping to identify subjects illegally pointing lasers at aircraft. This targeted regional reward pilot program ran for 60 days

in 12 metropolitan areas. FBI offered a reward of up to $10,000 for information that led to the arrest of a laser incident suspect. The program also included public service announcements and billboards educating the public that pointing a laser at an aircraft is a criminal act with potentially deadly repercussions. After 60 days, FBI expanded the program nationwide for an additional 90 days. According to one FBI official involved with the pilot program, no one ever claimed a reward.

Although there is no longer a targeted rewards program for laser incidents, FBI officials said a field office has offered rewards seeking information for any crime, including those involving laser strikes. For example, from November 2019 to January 2020, FAA reported three laser incidents on airplanes that were traced to the same general area in Effingham County, Georgia, about 10–15 miles North West of Savannah-Hilton Head International Airport. According to a press release from the FBI Atlanta field office, the FBI, in coordination with the Effingham County Sheriff and FAA, offered a reward of up to $2,500 for information leading to the arrest and conviction of the suspect(s) responsible for the laser strikes on aircraft approaching the airport.[43] In November 2020, a suspect was indicted by a U.S. District Court grand jury on three counts of aiming a laser pointer at an aircraft.

FDA Outreach Involves Educating the Public about Lasers through Its Websites

FDA conducts outreach to help educate the public about laser safety through multiple agency websites. The websites contain information about the compliant and appropriate uses of laser pointers as well as how laser pointers are misused and the dangers associated with misuse. Examples of misuse cited include laser pointers' being directed at a pilot in a plane, and the potential for such use to cause serious accidents.

Additionally, the FDA released a Consumer Safety Alert in 2019 notifying the public that FDA was aware of laser products, including surgical grade lasers, being sold on the internet that posed a risk if directed at aircraft.[44] The alert also noted that FDA was working to identify manufacturers of

[43]According to FBI officials, no reward was claimed or paid by FBI in the matter.

[44]Food and Drug Administration, *Consumer Safety Alert: Internet Sales of Laser Products* (June 13 2019).

illegal lasers and taking action to prevent these unsafe products from being sold in the United States including:

- engaging online marketplaces to help them identify and remove high-powered, illegal laser products listed on those websites and providing a liaison to an online marketplace group for addressing such issues; and
- collaborating with major express shippers in an effort to stop handling packages from manufacturers and distributors of non-compliant lasers that FDA has identified.

Federal Outreach Efforts on Laser Incidents Lack a Collaborative Mechanism

FAA coordinates with FBI on some public outreach efforts but does not have any formal outreach efforts with FDA. According to FAA officials, the agency has an ongoing relationship with FBI to collaborate on social media outreach efforts to educate the public. For example, FAA officials said FBI amplifies its social media efforts (e.g., reposting FAA's messages) related to laser incidents. FAA officials told us they contacted FDA about working together on laser incident outreach but were unable to solicit interest. FDA officials told us that they coordinate with FAA as needed but that currently, the agency does not have any formal outreach efforts planned.

From approximately 2010 to 2015 FAA, FBI, FDA and other federal agencies participated in an interagency laser incident-working group to proactively address aviation-related safety concerns.[45] According to an internal FAA document on the working group, one of the primary goals was to educate the public and aviation community on the hazards, effects, and consequences of aiming a laser at an aircraft

FAA officials said the working group facilitated initiatives that improved outreach to the public, pilots, and others. According to an FAA document on the working group, the working group helped ensure consistent messaging in conferences and educational outreach forums, and helped FBI prepare for its laser incident reward program. FAA officials told us additional benefits of the working group included educational and awareness outreach in partnership with FBI to aviation stakeholders, high

[45]DHS, including representatives from U.S. Customs and Border Protection and U.S. Coast Guard, was also a member of the working group.

and middle schools, and the public. This outreach included nationwide joint FAA and FBI press conferences in English and Spanish, and billboards showing an anti-laser message in cities with a high number of laser incidents.

FAA officials said the working group ended operations around 2015 because FAA decided to leverage the group's accomplishments to create policies on addressing laser incidents, such as enforcement policy. While the shift toward leveraging the group's accomplishments may have been a productive next step at the time, the number of laser incidents has increased and the difficulty in identifying subjects remains.

In our prior work, we found that collaborative mechanisms, such as interagency groups, could be used to implement programs and share information.[46] FAA, FBI, and FDA officials told us the agencies do not currently belong to any existing groups or mechanisms where the agencies could collaborate on public outreach efforts. As demonstrated by the previous interagency effort, a mechanism for sharing knowledge and information about laser incidents could help FAA, FBI, and FDA better target and leverage each other's outreach efforts to reduce the number of laser incidents.

Given FAA's responsibility for the safety of the national airspace and its role coordinating the prior effort, FAA is well positioned to lead an interagency effort to explore re-establishing this group. This could include reaching out to FBI and FDA about opportunities for leveraging outreach, potential agency roles, and goals for the collaboration.

Stakeholders Identified Ways to Mitigate Laser Hazards but Noted Implementation Challenges

Most stakeholders we spoke with told us that laser eye protection and pilot training are the most common ways to mitigate laser incidents.

[46]GAO, *Pay for Success: Collaboration among Federal Agencies Would Be Helpful as Governments Explore New Financing Mechanisms,* GAO-15-646 (Washington, D.C.: Sept. 9, 2015); GAO, *Managing for Results: Implementation Approaches Used to Enhance Collaboration in Interagency Groups,* GAO-14-220 (Washington, D.C.: Feb. 14, 2014) and *Managing for Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, GAO-12-1022 (Washington, D.C.: Sept. 27, 2012).

However, some stakeholders cautioned that cost and pilot adoption pose challenges to widespread use of eye protection technologies.

Laser Eye Protection

Most stakeholders cited laser eye protection technologies designed specifically for pilots as a way to reduce the hazards associated with laser incidents. These technologies can be incorporated into eyewear—such as glasses or visors—and are available for purchase from numerous companies. Laser eye protection glasses have colored filters that substantially reduce the amount of light reaching the eye within the wavelengths of most common handheld lasers. According to a brochure created by FAA's Aerospace Medical Education Division, this filtration reduces the potential for distraction and temporary blindness.[47]

According to FAA officials, FAA tested laser eye protection glasses with pilots in a simulator, and found that such glasses performed well in reducing distraction, glare, flash blindness, and assorted after-images. The officials also told us there are many variables to consider regarding protective eyewear such as the color and strength of the laser. Most common laser eye-protection glasses filter green and blue laser wavelengths. No single piece of eyewear offers protection against all laser wavelengths, according to FAA.

In addition to eyewear, aircraft manufacturers are working with other industry stakeholders to develop a windshield film to mitigate laser strikes in a way similar to the glasses. According to representatives of a protective eyewear manufacturer, applying film to aircraft windshields would allow pilots to operate normally without needing to put on glasses or lower a visor. FAA officials told us this windshield film is a new technology. Officials said if an aircraft manufacturer or industry stakeholder wishes to use or sell a windshield film, they would need to apply and go through the FAA certification process for approval of this technology. FAA currently has no applications or projects for windshield film certification.

[47]FAA, *Laser Eye Protection (LEP) Perceptual Effects on Aviation,* (Oklahoma City: OK, 2018).

Stakeholders that suggested laser protection eyewear as an option cautioned that although it can be beneficial, cost and potential effects on pilot vision remain challenges.

- **Cost.** Most stakeholders told us the cost of laser eye protection was a challenge to widespread use. Representatives of a manufacturer of film used in producing protective eyewear told us they generally commercially sell their eyewear for $200 to $500, but the cost varies depending on the size of an order. According to representatives from one pilots group, any mitigation efforts would have to consider what is appropriate for commercial airlines and general aviation in terms of cost. A representative for another pilots' group—who is also a commercial pilot— reiterated this point and said that the airline the pilot works for would need to purchase approximately 14,000 pairs of eyewear and that cost would be a major consideration.
- **Potential effects on pilot vision.** In addition to the cost, several stakeholders told us another challenge to laser eyewear protection is the potential effect on pilot vision. Pilots may choose not to use laser eyewear protection for reasons including the potential effect on color perception and possible interference in flying their aircraft. Several stakeholders, including pilots, said laser eye protection can affect a pilot's vision, and pilots may consider the hazards associated with wearing the eyewear as outweighing the benefits.

  In 2019, FAA conducted a study to explore the effect of laser eye-protection technology on color perception of aviation signal lighting, and found it could interfere with accurate perception of aviation signal lighting.[48] According to FAA, glasses with green filters reduce the amount of green light present, and any remaining light will become more dominant. Depending on the type of light being viewed—incandescent with various filters or different light emitting diodes (LED)— a green light might appear more blue or more yellow, and a white light may appear more yellow or red. FAA officials told us they continue to view accurate color perception as a consideration and a challenge in using protective eyewear. The officials noted FAA has ongoing research to evaluate various laser protection eyewear, and that pilots and aircrews should take the time, while flying, to become familiar with the color shifts that might result from using the eyewear if they plan to use the eyewear.

[48]FAA, *Laser Eye Protection and the Effect of Two Types of Light-Emitting Diodes (LEDs) on Color Perception,* (Washington, D.C. Sept. 2019).

Pilots may also be reluctant to wear protective eyewear for other reasons related to vision and flying. For example, a law enforcement-helicopter pilot told us the biggest downside to wearing protective eyewear is losing depth perception when it comes to power lines and said that many of the hazards helicopter pilots deal with in low-level flying become difficult to identify. The pilot added that some helicopter pilots they work with would not fly with the protective eyewear because they view wearing the eyewear as unsafe. FAA officials told us helicopter pilots, particularly those in law enforcement, also need to consider whether laser eye protection will impair their ability to use night vision goggles.

Pilot Training

Most stakeholders told us that training pilots on how to respond to laser incidents is an important mitigation strategy. For example, representatives from an organization representing law enforcement pilots told us that training pilots in responding to laser incidents is important because there will always be laser incidents. These representatives said that even with effective public outreach and enforcement activities, there would be people intentionally trying to harm aircraft and that in these situations, it is important for pilots to know how to react. Additionally, representatives from a group representing pilots told us they recommend airlines develop and incorporate a laser strike training module at a minimum of every 2 years.

According to representatives from Air Line Pilots Association and Airborne Public Safety Association, they have conducted training for their members and produced publicly available training documents to help ensure pilots are properly informed and prepared to respond to a laser incident. For example, the Air Line Pilots Association created a webpage on responding to laser incidents that lists recommended actions in the event an aircraft is lased.[49] The recommended actions include:

- turning up instrumentation and panel background lighting;
- transferring control of the aircraft to other pilot, if necessary;

[49]Air Line Pilots Association International, *Laser Illumination Threat, Guidance, and Crew Actions* (Herndon, VA).

- notifying air traffic control and providing the most accurate description of the event including the possible location of the laser, and the color and length of exposure;
- obtaining a post-landing eye examination at the nearest emergency room to determine if eye damage occurred; and
- cooperating with law enforcement officials conducting a follow-up investigation.

Representatives from the Airborne Public Safety Association told us they provide training to their members, including law enforcement pilots, focused on addressing the effects of laser incidents on the eyes and how to mitigate risk of a laser incident and continue to fly after a laser incident.[50] The training also included segments on how to identify the source of the laser strike, where to direct local law enforcement in hopes of apprehending a subject, and how to report the information to FAA and FBI. Additionally, the representatives said the training incorporated different types of laser eye protection, including glasses and visors, and discussed when pilots should lower a helmet visor or put on glasses. FAA officials told us they have worked with other groups such as the Aircraft Owners and Pilots Association to train pilots on responding to laser incidents.

Conclusions

Laser strikes on aircraft are increasing in number and the risks to aircrew and passenger safety have led FAA to treat each incident as an in-flight emergency. FAA and law enforcement have taken action against subjects involved with laser incidents; however, identifying these subjects remains difficult. To help support laser incident investigations, FAA developed a voluntary post-incident questionnaire to collect additional information from pilots and crewmembers. However, response rates are low, pilots may not believe completing the questionnaire is worthwhile; and FAA does not consistently share the information collected with law enforcement. Determining what information is most useful to investigators could help FAA and law enforcement identify subjects and ultimately take action against them.

[50]The Airborne Public Safety Association supports, promotes and advances the safe and effective use of aircraft by governmental agencies in support of public safety operations through training, networking, advocacy, and educational programs.

FAA also faces challenges meeting its requirement to report to Congress on federal actions related to laser incidents. Because FAA but does not routinely collect this information from other agencies or explain data limitations, these reports are not complete and decision makers, including Congress, may face challenges in assessing the government's efforts to deter and mitigate laser incidents. FAA, FBI, and FDA have all taken steps to educate the public about the dangers of illegally pointing lasers at aircraft in an effort to reduce laser incidents. Given that laser incidents are at an all-time high, exploring whether an interagency working group, similar to what was in place until 2015, could strengthen their collective outreach activities and better deter incidents.

Recommendations for Executive Action

We are making the following three recommendations to FAA:

The FAA Administrator should determine what information from pilots and crewmembers would be most useful for investigating laser incidents, and how best to collect the information and to share it with law enforcement. (Recommendation 1)

The FAA Administrator should improve its quarterly reports to Congress on laser incidents by routinely seeking information from other agencies on related federal investigation and enforcement actions and disclosing, in those reports, any limitations with the data. (Recommendation 2)

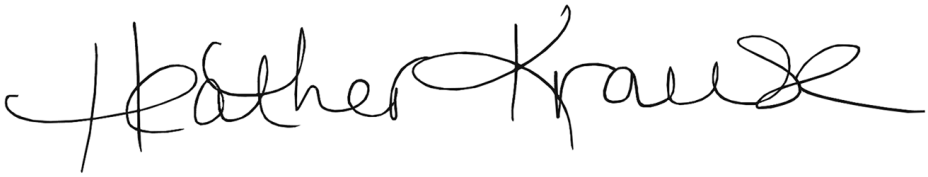
The FAA Administrator should work with FBI and FDA to explore re-establishing an interagency working group on outreach to educate the public on the hazards of lasers and the illegality of aiming lasers at aircraft. (Recommendation 3)

Agency Comments

We provided a draft of this report to DOT, DOJ, DHS, and HHS for review and comment. In its written comments, reproduced in appendix IV, DOT agreed with our three recommendations. DOT also provided technical comments, which we incorporated as appropriate. DOJ, DHS, and HHS officials provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretaries of Transportation, Homeland Security, and Health and Human Services, the Administrator of the FAA, the Attorney General, and other interested parties. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or krauseh@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix V.



Heather Krause
Director, Physical Infrastructure

Appendix I: Objectives, Scope, and Methodology

This report examines: (1) the extent to which FAA and other federal agencies take enforcement action against those who point lasers at aircraft and the challenges with investigations and reporting;(2) public outreach efforts FAA and other federal agencies have taken to deter laser incidents, and what actions, if any, would strengthen these efforts; and (3) options that stakeholders have identified to mitigate the effects of laser incidents, and the potential benefits and challenges to implementation.

To determine how FAA responds to laser incidents and the extent to which enforcement actions are taken against those who point lasers at aircraft, we reviewed relevant statutes, regulations, and FAA documents related to reporting and investigating laser incidents and taking enforcement actions.[1] These FAA documents included: the 2020 advisory circular for reporting laser incidents,[2] guidance for law enforcement on identifying and reporting laser incidents, [3] and FAA compliance and enforcement program guidance.[4]

We analyzed FAA data on the number of laser incidents from calendar years 2010 (when FAA began tracking data on laser incidents) through May 2022 (the most recent data available) to show trends in reported laser incidents. We also analyzed FAA data on laser-incident enforcement actions, such as the number of orders assessing civil penalties, from July 2016 (when FAA began tracking actions) through September 2020 to determine the number and magnitude of penalties. We assessed the reliability of these data by reviewing documents provided by FAA and interviewing cognizant FAA officials. We also conducted manual data tests of a randomized sample of incidents to look

[1]Our review included the FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 311, 126 Stat. 11, 65 (codified at 18 U.S.C. § 39A(a)), the FAA Extension, Safety and Security Act of 2016, Pub. L. No. 114-190, § 2104, 130 Stat. 615, 620 (2016 Act), and 14 C.F.R. § 91.11.

[2]FAA, AC-70-2B, *Reporting Laser Illumination of Aircraft* (Apri.3, 2020).

[3]FAA, *Law Enforcement Guidance for Identifying and Reporting Unauthorized Laser Illumination Incidents Against Aircraft*, (Mar. 1, 2022).

[4] FAA Order 2150.3C. *FAA Compliance and Enforcement Program*.

for overlap, duplication, and dates outside the time period in question. While we identified data limitations, as discussed in this report, we determined the data were sufficiently reliable for our purpose of identifying trends in enforcement actions against subjects involved in laser incidents

We also analyzed data from the Executive Office for U.S. Attorneys (EOUSA) CaseView database from July 2016 through September 2020 to determine the number and magnitude of penalties, such as imprisonment. The database contains the number of laser incidents referred to U.S. Attorneys Offices (USAO) for prosecution and criminal enforcement actions. Furthermore, we analyzed the quarterly reports that FAA is required to produce and submit to Congress on the numbers of laser incidents, and civil and criminal penalties, among other things.[5] We performed a comparative analysis of quarterly reports from the fourth quarter of fiscal year 2016 through the fourth quarter of fiscal year 2021[6] to our analysis of both FAA's internal data on laser incidents and EOUSA data. This analysis was performed to help determine whether FAA coordinates with federal law enforcement and reports, to Congress as required by the 2016 Act, the number of civil or criminal enforcement actions, civil and criminal penalties, and the resolution of any laser incidents that did not result in a civil or criminal enforcement action. We reviewed prior GAO work on the reliability of CaseView data and assessed the reliability of these data by reviewing documents provided by EOUSA and interviewing cognizant officials. We determined the data were sufficiently reliable for our purposes of describing the limitations of enforcement data reported to Congress.

We determined the following component of internal control in the federal government were significant to this review:[7] Quality information, along with the underlying principles that management should use quality

[5]Section 2 of the 2016 Act specifies the committees of Congress to which FAA is to provide these reports. These committees are the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives.

[6]We used quarterly reports through the first quarter of fiscal year 2021 since FAA reports the number of laser incidents and enforcement actions taken during the quarter, and provides updates for previous reports back to 2016.

[7]GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: September 2014).

information to make informed decisions and evaluate the entity's performance in achieving key objectives and addressing risks.

We assessed FAA's actions related to collecting and tracking the number of civil and criminal enforcement actions taken by federal agencies with regard to laser incidents. To determine the actions FAA and other federal agencies have taken to deter laser incidents, and what additional actions would strengthen these efforts, we reviewed documents on laser incidents to identify other federal agencies with roles in deterring laser incidents. Based on this review, we interviewed officials with the Federal Bureau of Investigation (FBI), Food and Drug Administration (FDA), and Department of Homeland Security to determine if these agencies have a role in deterring laser incidents.[8]

To determine FAA, FBI and FDA's public outreach actions, we reviewed FAA's websites related to laser incidents, and documents related to social media accounts, and the associated metrics FAA uses to track the number of times people saw a post, tweet, or played a video related to laser incidents. We also reviewed a 2021 report on laser incidents from George Mason University prepared in partnership with FAA.[9] To determine FBI's actions, we reviewed FBI's social media accounts and documents on FBI's 2014 reward program aimed at deterring laser strikes through public outreach and the apprehension of subjects involved in laser incidents. To determine FDA's actions, we reviewed FDA's websites on laser incidents and consumer safety alerts related to lasers.[10] We analyzed FAA's data on laser incidents to identify the 10 areas with the highest number of laser incidents and selected three areas (Los Angeles, Houston, and Phoenix) with a high number of laser incidents. We collected information on actions taken to deter laser incidents in the selected areas, including public outreach from FAA, FBI, and local law enforcement. We also reviewed documents from an interagency laser strike-working group established in 2010 and active until 2015 that

[8]Based on these interviews, we determined that FBI has a role in federal law enforcement actions and FDA has a role, since the agency has authority to regulate all kinds of lasers. Officials from the Department of Homeland Security told us they have no role in investigating or deterring laser incidents, and based on this response, we did not include them in our evaluation.

[9]George Mason University, *FAA Air Traffic Organization Security Log Analysis – Laser Strikes* (May 2021).

[10]Food and Drug Administration, *Consumer Safety Alert: Internet Sales of Laser Products* June 13, 2019.

focused, in part on deterring laser incidents. In our prior work, we found that collaborative mechanisms such as interagency groups could be used to develop policies, implement programs, and share information.[11]

To determine the options stakeholders have identified to mitigate the effects of laser incidents and the potential benefits and challenges to implementation, we reviewed FAA reports on laser incident mitigation, including pilot awareness efforts or training and emerging technologies, such as laser glare protection eyewear. We also reviewed documents including reports, plans, and presentations related to laser mitigation efforts, such as the International Civil Aviation Organization Manual on Lasers and Flight Safety.

To inform all three objectives, we interviewed officials from FAA, FBI, EOUSA, and FDA. We conducted semi-structured interviews with representatives from a non-generalizable sample of 15 aviation stakeholders, local law enforcement agencies, and stakeholders from organizations developing mitigation strategies and recommendations to address laser incidents. We selected stakeholders based on literature search results, recommendations from FAA, FBI, and FDA, and prior GAO work to represent a range of aviation and local law enforcement perspectives. See table 2 for list of stakeholders we interviewed. We do not enumerate stakeholder responses in the report. Instead, we analyzed the responses and reported on common themes that arose during the stakeholder interviews. Because we selected a non-generalizable sample of stakeholders, their responses should not be used to make inferences about a population. To characterize stakeholders' views in some cases, we defined modifiers (e.g., "some") to quantify stakeholders as follows:

- "several" stakeholders represents stakeholders in 3 to 5 of the interviews,
- "some" stakeholders represents stakeholders in 6 to 10 of the interviews, and
- "most" stakeholders represents stakeholders in 11 or more of the interviews.

[11]GAO, *Managing for Results: Implementation Approaches Used to Enhance Collaboration in Interagency Groups,* GAO-14-220 (Washington, D.C.: Feb. 14, 2014) and *Managing for Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, GAO-12-1022 (Washington, D.C.: Sept. 27, 2012).

Table 2: List of Stakeholders Interviewed

Aviation Stakeholders
Airborne Public Safety Association (APSA)
Aircraft Owners and Pilots Association (AOPA)
Air Line Pilots Association (ALPA)
Airports Council International North America (ACI-NA)
Helicopters Association International (HAI)
LaserPointerSafety.com
National Business Aviation Association (NBAA)
Engineering and Research Firms
Meta Materials Inc. (META)
MIT Lincoln Laboratory
Local Law Enforcement Agencies
Airport Law Enforcement Agencies Network (ALEAN)
Houston Police Department
Los Angeles Police Department
Los Angeles Sheriff's Department (LASD) Aero Bureau
Los Angeles World Airports (LAWA)
Phoenix Police Department

Source: GAO. | GAO 22-104664

We conducted this performance audit from November 2020 to August 2022, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Food and Drug Administration's Laser Classifications, Hazards, and Product Examples

The Food and Drug Administration (FDA) organizes lasers based on class, with four major hazard classes (I to IV) of lasers, including three subclasses (IIa, IIIa, and IIIb). The higher the class, the more powerful the laser is and the greater the potential to pose serious injury if used improperly. Manufacturers are required to, among other things, classify laser products as Class I, II, IIa, IIIa, IIIb, or IV; certify conformance with all applicable standards for electronic products by means of a product label;[1] and submit a report demonstrating that applicable mandatory radiation safety-performance standards are met. See table 3 for FDA classes of lasers, potential hazards, and examples of different products in those classes.

Table 3: Food and Drug Administration's (FDA) Classes of Lasers, Hazards, and Product Examples

FDA Class	Hazard	Product examples
I	Considered non-hazardous. Hazard increases if viewed with optical aids, including magnifiers, binoculars, or telescopes	Laser printers, CD players, DVD players
IIa, II	Hazard increases when viewed directly for long periods of time. Hazard increases if viewed with optical aids.	Bar code scanners
IIIa	Depending on power and beam area, can be momentarily hazardous when directly viewed or when staring directly at the beam with an unaided eye. Risk of injury increases when viewed with optical aids.	Laser pointers
IIIb	Immediate skin hazard from direct beam and immediate eye hazard when viewed directly.	Laser light show projectors, industrial lasers, research lasers
IV	Immediate skin hazard and eye hazard from exposure to either the direct or the reflected beam; may also present a fire hazard.	Laser light show projectors, industrial lasers, research lasers, medical device lasers for eye surgery or skin treatments

Source: FDA. | GAO-22-104664

[1]The labeling for Classes II–IV must include a warning symbol that contains specific information, including the class and the output power of the product. Class I lasers are not considered hazardous and require no special labeling.

Appendix III: The Federal Aviation Administration's Laser Beam Exposure Questionnaire

Paperwork Reduction Act Burden Statement: A federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act unless that collection of information displays a currently valid OMB Control Number. The OMB Control Number for this information collection is 2120-0698. Public reporting for this collection of information is estimated to be approximately 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information. All responses to this collection of information are voluntary. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to the FAA at: 800 Independence Ave. SW, Washington, DC 20591, Attn: Information Collection Clearance Officer, ASP-110.

OMB Control Number: 2120-0698
Expiration Date: 03/31/2013

Federal Aviation Administration

LASER BEAM EXPOSURE QUESTIONNAIRE

Complete questionnaire and e-mail to: laserreports@faa.gov
OR send via fax to FAA Washington Operations Center Complex (WOCC) - (202) 267-5289 ATTN: DEN

CONTACT INFORMATION

Name of pilot/crewmember reporting

E-mail address and phone number (*e.g., home, cell, work*)

What seat in the cockpit were you occupying at the time of the laser beam exposure?

○ Left ○ Right ○ Jumpseat ○ Flight Engineer ○ Other/Not applicable

How many crewmembers on the flight had laser light shined directly in their eyes?

○ None (the laser light beam did not directly enter anyone's eyes)

○ One ○ Two ○ Three ○ Four or more

Note: If any other crewmember had direct exposure to the laser light in their eyes, each person exposed should complete their own copy of this FAA Laser Beam Exposure Questionnaire

FLIGHT INFORMATION

Flight number, call sign and aircraft registration number (e.g., SWA572, Southwest, N287WN)

Aircraft Make and Model (e.g., Boeing 737, Cessna 172, Airbus A320, BAE Jetstream 32, Dornier 328)

Category of aircraft

○ Airplane ○ Rotorcraft ○ Lighter than air ○ Other (specify)

Type of operation

○ Commercial Aviation ○ General Aviation ○ Military ○ Law Enforcement

○ Medical ○ News Reporting ○ Other (specify)

Date of laser incident

Please enter date of laser incident in Month Day, Year format (e.g., July 27, 2012). OR mouse click in the data field to display a drop down arrow to view calendar and make your selection. The calendar selection is optimized for PC's and may not be available on a Mac.

Time of laser incident (enter Universal Time Coordinated (UTC/Zulu) format rounded to the nearest five minutes)

: UTC/Zulu

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Time of day during laser incident

Location of aircraft during laser incident (Fixed Radial Distance (FRD) from navaid or airport, **OR** add lat/long coordinates)

Estimated geographic location of the laser source (e.g., the laser source relative to KDFW approach end of runway 35L was approximately 220 degree radial and 2 miles. You can also provide estimated lat/long coordinates)

Approximate altitude of the aircraft above ground level (AGL)

Primary direction of flight at the time of the laser incident

N NW NE E
S SW SE W None/Hover

What phase(s) of flight were you in during the laser incident? (check all that apply)

Taxi Takeoff Climb to altitude Cruise altitude
Descent Final approach Landing Low-altitude (<500 ft. AGL) level flight
Hover Other (specify)

EFFECT ON FLIGHT

Interference: Did the laser illumination incident interfere with your performance of pilot or crewmember duties during the flight?

Yes No

If you selected "Yes" above, how did the laser illumination interfere with your pilot or crewmember duties?

Flight Path: Did the laser illumination cause the pilot/crew member to change the aircraft flight path?

No change in flight path Minor or non-adverse change Major or adverse change

Disruption of Mission: Answer this question ONLY if you were conducting law enforcement, medical or military flight operations during the time of the laser illumination incident. **Did the laser illumination incident disrupt your mission?**

Yes No

If you selected "Yes" above, how did the laser illumination interfere with your mission?

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LASER INFORMATION

Color of the laser light? (if multi-colored, check all that apply)

☐ Red ☐ Blue ☐ Green ☐ Yellow ☐ Orange ☐ White ☐ Purple

☐ Other (specify) _____

Tracking: Did the laser beam appear to deliberately track the aircraft?

○ Yes ○ No ○ Unsure/other (specify) _____

Cockpit illumination: Did the laser beam enter through the windscreen and illuminate any part of the cockpit?

○ Yes ○ No ○ Other (specify) _____

Eye exposure: Did the the laser beam light shine directly into one or both of your eyes?

○ Did not shine directly in my eye(s) ○ Shined a little in my eye(s) ○ Shined brightly in my eye(s)

EFFECT ON YOUR EYE(S): Answer questions below **ONLY** if the laser beam shined a little or brightly in your eye(s)

Did you experience any adverse VISION EFFECTS* from the exposure? (check all that may apply)

- ☐ Did not experience adverse vision effects
- ☐ Glare (could not see past the light while it was in your eye(s))
- ☐ Temporary flash blindness and/or after images (similar to a camera flash)
- ☐ One or more blind spots (spots in visual field lasting longer than 5-10 minutes)
- ☐ Blurry vision
- ☐ Significant loss of night vision
- ☐ Other (specify) _____

Examples of common vision effects

Glare: *A temporary disruption in vision caused by the presence of a bright light (such as an oncoming car's headlights) within an individual's field of vision. Glare lasts only as long as the bright light is actually present within the individuals field of vision.*
Flash blindness: *A temporary visual interference effect that persists after the source of the illumination has ceased, similar to a bright camera flash.*
After image: *An image that remains in the visual field after an exposure to a bright light.*
Blind spot: *A temporary or permanent loss of vision of part of the visual field. Unlike an after image, a blind spot does not fade, or fades very slowly (taking many minutes, hours or days to fade out).*

Did you experience any adverse PHYSICAL EFFECTS from the exposure? (check all that may apply)

- ☐ Did not experience adverse physical effects
- ☐ Watering eye(s)
- ☐ Eye(s) discomfort or pain
- ☐ Headache
- ☐ Feeling of shock
- ☐ Disorientation or dizziness
- ☐ Other (specify) _____

Did you rub your eye(s) after the exposure?

○ No significant rubbing ○ Rubbed them a little ○ Rubbed them vigorously

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EYE EXAM RESULTS: Answer questions below **ONLY** if you had an eye exam after the laser incident

Enter the medical facility name:

What type of doctor did the primary or most comprehensive examination of your eye(s)?

- ◯ Retinal Specialist
- ◯ Ophthalmologist (medical doctor specializing in eye health)
- ◯ Optometrist (tests for visual acuity and eye diseases; prescribes and fits glasses/contacts)
- ◯ Optician (fits glasses/contacts)
- ◯ Emergency room doctor, nurse or technician
- ◯ Other (specify)

Describe the results of the medical evaluation:

LASER INCIDENT REPORTING

Did you report the incident to Air Traffic Control (ATC)?

- ◯ Did not report to ATC
- ◯ Reported via aircraft radio communication
- ◯ Reported via phone call
- ◯ Reported via walk-in to FAA ATC facility
- ◯ Other (specify)

Did you report the laser incident to an FAA Flight Standards (AFS) field office? (e.g., FSDO, CMO, CHDO)

- ◯ Did not report to AFS
- ◯ Reported via aircraft radio communication
- ◯ Reported via phone call
- ◯ Reported via walk-in to FAA AFS field office
- ◯ Other (specify)

If you reported to an FAA AFS field office, enter the name and office location

FAA - Laser Beam Exposure Questionnaire - 09-22-2012 - RAC - R8 Page 4 of 5

ADDITIONAL INFORMATION

Did you have any prior knowledge or training on the hazards and effects of lasers aimed at a pilot/crewmember?

- ◯ None
- ◯ Basic information about the hazards and effects of lasers
- ◯ Detailed, specific information such as how to recognize and recover from laser illuminations
- ◯ Simulator training or similar exposure to laser-like illuminations in an aviation training environment
- ◯ Other (specify)

Please feel free to add any additional information or comments about your flight, the laser incident, reporting, and/or subsequent outcome:

THE FOLLOWING SECTION IS FOR ATC FACILITIES USE ONLY

Did you report the unauthorized laser illumination incident to the Domestic Incidents Network (DEN)?

◯ No ◯ Yes

What local law enforcement agency did you contact? (Include their phone number)

Was an arrest made?

- ◯ No arrest, or arrest unlikely
- ◯ Maybe, still working the case
- ◯ Yes, arrest was made
- ◯ Arrest status is unknown
- ◯ Other (specify)

SUBMIT COMPLETED FAA LASER BEAM EXPOSURE QUESTIONNAIRE

Thank you for taking time to complete this questionnaire. Please "save" the completed questionnaire and submit to the FAA using one of the two methods described below:

1. **Attach the saved PDF to an e-mail and send to: laserreports@faa.gov**
2. **Send via fax to FAA Washington Operations Center Complex (WOCC) - (202) 267-5289 ATTN: DEN**

Print Questionnaire

FAA - Laser Beam Exposure Questionnaire - 09-22-2012 - RAC - R8 Page 5 of 5

Text of Appendix III: The Federal Aviation Administration's Laser Beam Exposure Questionnaire

Appendix IV: Comments from the Department of Transportation

U.S. Department of Transportation

Office of the Secretary of Transportation

Assistant Secretary for Administration

1200 New Jersey Ave., SE
Washington, DC 20590

July 27, 2022

Heather Krause
Director, Physical Infrastructure
U.S. Government Accountability Office (GAO)
441 G Street NW
Washington, DC 20548

The Federal Aviation Administration (FAA) is committed to maintaining the safest air transportation system in the world. Aiming a laser at an aircraft is a serious safety hazard and a violation of federal law. The FAA works with other federal agencies, state and local governments, and industry stakeholders to investigate, apprehend suspects, report, and advocate for the prosecution of offenders. In an effort to reduce laser attacks, the agency conducts outreach efforts to educate the public and industry stakeholders about the hazards and effects of lasers aimed at aircraft, as well as the legal consequences.

Upon review of the draft report, we concur with GAO's three recommendations that FAA (1) determine what information from pilots and crewmembers would be most useful for investigating laser incidents, and how best to collect the information and share it with law enforcement, (2) improve its quarterly reports to Congress on laser incidents, and related federal investigation and enforcement actions, by routinely seeking the information from other agencies and disclosing, in those reports, any limitations with the data, and (3) work with FBI and FDA to explore re-establishing an interagency working group on outreach to educate the public on the hazards of lasers and illegality of aiming lasers at aircraft. We will provide a detailed response to each recommendation within 180 days of the final report's issuance.

We appreciate the opportunity to respond to the GAO draft report. Please contact Gary Middleton, Director, Audit Relations and Program Improvement, at (202) 366-6512 with any questions or if you would like to obtain additional details.

Sincerely,

Philip A. McNamara
Assistant Secretary for Administration

Text of Appendix IV: Comments from the Department of Transportation

U.S. Department of Transportation
Assistant Secretary for Administration
1200 New Jersey Ave., SE Washington, DC 20590
Office of the Secretary of Transportation

July 27, 2022

Heather Krause
Director, Physical Infrastructure
U.S. Government Accountability Office (GAO)
441 G Street NW
Washington, DC 20548

The Federal Aviation Administration (FAA) is committed to maintaining the safest air transportation system in the world. Aiming a laser at an aircraft is a serious safety hazard and a violation of federal law. The FAA works with other federal agencies, state and local governments, and industry stakeholders to investigate, apprehend suspects, report, and advocate for the prosecution of offenders. In an effort to reduce laser attacks, the agency conducts outreach efforts to educate the public and industry stakeholders about the hazards and effects of lasers aimed at aircraft, as well as the legal consequences.

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Sincerely,
Philip A. McNamara
Assistant Secretary for Administration

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

Heather Krause, (202) 512-2834 or KrauseH@gao.gov.

Staff Acknowledgments

In addition to the contact named above, the following individuals made important contributions to this report: David Sausville, Assistant Director; Aaron Kaminsky, Analyst-In-Charge; Melissa Bodeau; Dwayne Curry; Melanie Maralit Diemel; Kelly Rubin; James Russell; Janet Temko-Blinder; and Alicia Wilson.

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