

# A Format Proposal for Reporting SLR-Airspace Interaction Events

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## First: A correct name is important!

*(What's in a name? that which we call a rose, By any other name would smell as sweet)*

Insiders at the SLR community usually say "We shoot at 10 Hz, but for HEO we shoot at 5 Hz", or "We start shooting at 15 degrees elevation". But in communicating to the general public, and government institutions with phrases as "We have an alarm system to avoid shooting laser pulses to an airplane", sounds very dangerous and creepy!

So we should define, propose and use a name that is:

- Precise.
- Neutral on Danger Perception and Responsibility.
- Technical looking.
- Sounding good!

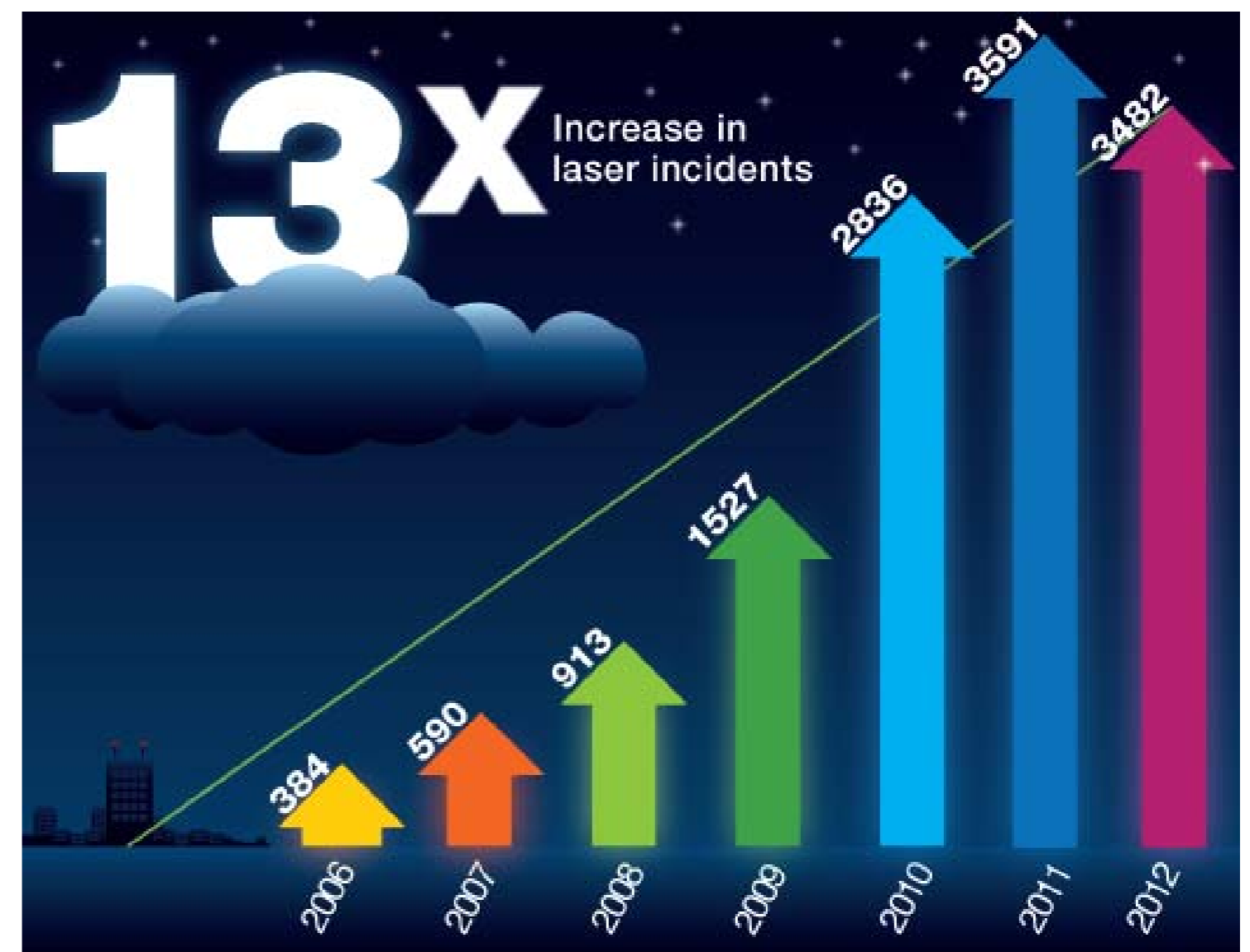
Two names can fill all these requirements:

- **Aircraft Illumination Avoidance (AIA)**
- **SLR-Airspace Interaction Events (SIE)**

Using the **AIA** acronym could hint that, somehow, the SLR station is actively following the Airplane (*We have to avoid the airplane*). While in fact, *if* this event happens, it is the airplane who, without knowing, is crossing the SLR laser beam path.

The **SIE** acronym, is more neutral.

**SIE** is used in this poster and is our proposal to the SLR community to be used as the preferred name.



Cases reported to the FAA

## Introduction:

This problem started about 20 years ago, when relatively cheap and powerful laser pointers started to appear on the market. The amount of events was kept very low until the middle 2000's when the green light pointer model became popular. In 2006 the United States FAA (Federal Aviation Administration) started to keep record of these events, Now there is not only a place to register the incidents, but a strong set of laws to pursue and punishing the people who do this.

In Australia, law forbids importing and using high power green laser pointers. And the European Union and individual European countries are also legislating in this sense.

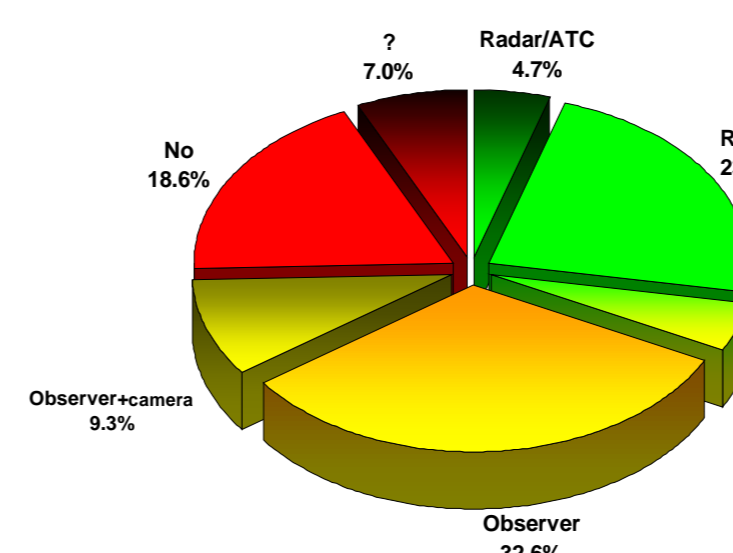
(For more information, see [faa.gov/aircraft/safety/report/laserinfo/](http://faa.gov/aircraft/safety/report/laserinfo/)).

## The following SIE methods can be used either singly or in a combination:

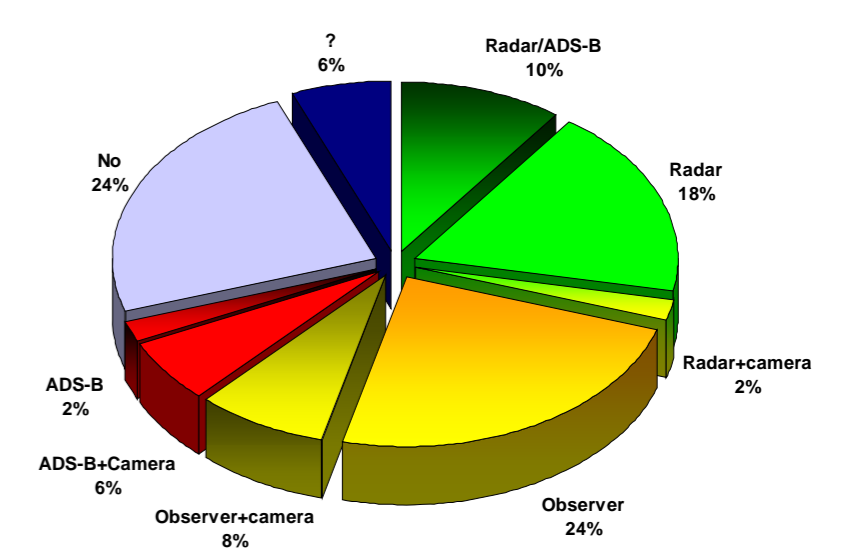
- 1.- Classical microwave radar moving the parallel with the laser beam.
- 2.- An ADS-B receiver, with the position information from commercial airlines flying near the SLR Station.
- 3.- A CCD camera with software to identify objects near the laser beam.
- 4.- A dedicated human observer using either Optics or a TV camera.
- 5.- A Hotline connecting with a near Air Traffic Control Center.
- 6.- Using WWW pages monitoring the air traffic.
- 7.- Having a restricted airspace near the SLR station.
- 8.- SLR on isolated place, no significant air traffic, no need to monitor.

Since 2011 at least 6 SLR stations reported adding an ADS-B receiver to the local SIE surveillance methods used. On the other side several of the newly added SLR stations, does not report any special method of surveillance, many of them are in relatively isolated places.

## Aircraft Detection Method 2011



## Aircraft Detection Method 2014



Distribution of SIE technology as reported on the log files  
2011: 44 SLR stations      2014: 52 SLR stations

## Should the ILRS keep a global database of the SIE Events?

This is something that has to be considered very carefully. Not because it is technically possible, means should be done. Not all the implications are positive for its implementation, facts as legal sovereignty and data ownership, liability claims, perception by the general public of the information released should be taken into account.

### For keeping a global ILRS SIE database:

- The ILRS will have solid data to prove that the numbers of SIE events are insignificant in relation to the number of stations and satellite observations.
- Will help to study the geographic distribution effects in relation to flight paths.
- An important bargain point, during related law discussion, or to define a special legal status for SLR systems.
- Will prove that the money invested by the SLR stations on SIE technology is effective.
- A solid point when asking for SIE upgrade funding.

### Against keeping a global ILRS SIE database:

- Can this information be used in legal proceedings against the ILRS, SLR station or parent institutions?
- Are all the SLR stations allowed to release this information to an open global database?
- Are time delay limits for the information release?
- Will be legally convenient NOT to have a real time reporting?
- Can be possible to report the event without identifying the SLR station?
- In the case, of anonymous reporting, can the ILRS be legally forced to identify the SLR station that reported?
- In case the database is kept in different data centers, according to which set of laws the information will be managed?



This was NOT caused by a SLR laser beam!

## The SIE Format

The primary global code to be reported by all SLR Stations.

The secondary code reported only by the properly equipped SLR Stations.

Detector	Code
Radar	1
ADS-B	2
Camera	4
Observer	8
WWW/Hotline	16

MJD	Minutes (0 UTC)	Station Code	Satellite Code	Detection Code	Trigger Distance (degrees)	Min Distance (degrees)	Epoch of Min (seconds 0 UTC)	Range@Min Distance	Airplane Registration Code
41913	148	9999	8606101	8	1				
41943	1418	9996	9207002	3	2	0.369	85083	16.128	OH-LVC

At what distance from the laser beam the security measures are taken. Normally it is a fixed value at each Station.

If this value is very close to zero, it could be assumed that the plane was illuminated by the SLR laser.

In order to calculate the energy density at the plane and the eye effects.

Gives information on the plane windows sizes and its placement. For more refined calculation of the laser energy inside the plane.

## Defining the reporting format

Switching off the laser at the SLR system when an airplane enters a security area near the SLR laser pointing position **does not means** that in all cases the airplane was to be **illuminated by the laser beam**.

Different technological levels to address the SIE problem means different levels of information. The primary level of reporting will cover the 4 basic points of the SIE event:

- **When?**
- **Where?**
- **Which Satellite was being observed?.**
- **How it was determined a SIE event?**

This information can be reported by any technology currently available and is the basic format level.

One of the most interesting part of the monitoring is to find any case that the plane would has been **REALLY** illuminated if the laser beam has not been switched off. Only SLR stations with the proper technology and software will be able to determine the minimum angular distance between the airplane and the satellite path and confirm if a laser illumination would had occurred.

This secondary level of reporting covers 4 points of the SIE event:

- **What would have been the minimum distance between the laser beam and a plane?**
- **When it was?**
- **At what distance from the SLR was the airplane?**
- **Is possible to identify the plane?**

For this a combination of Radar, ADS-B and or Air Traffic monitoring technologies are needed.

## At the 20<sup>th</sup> Potsdam Workshop: How to implement the database and the reporting data flow?

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Stay tuned!

19th International Laser Ranging Workshop  
"Celebrating 50 Years of SLR: Remembering the Past and Planning for the Future"  
Annapolis, MD USA October 27-31/2014

## Making the SIE information "reader friendly"

The full format should be as compact as possible, and not necessarily the most user readable. At the database centers this information can be expanded to be in a more "reader friendly" format.

The "Where?" question can be reported using the station code only. The "How?" can be addressed giving a numerical code to each technology so any number is a single or a combination of SIE technologies.