

IMO Fireball report form: results and prospects

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At the 2014 IMC, we presented the new IMO (International Meteor Organization) online, Fireball report (available at fireballs.imo.net). This fireball report form was specifically designed for use by people with no astronomy experience who witnessed a fireball, a bolide or a suspected similar phenomenon. The IMO version of the form has been officially launched in February 2015. Since then, the form has been translated in different languages and customized for organizations around the world. In this paper, we will present preliminary results of the form and provide tips to improve the online presence of local organizations, in order to promote usage. We will also highlight procedures to be followed by local organizations to get a custom version of the form.

1 First reports, first events

At the request of the IMO Council, the original American Meteor Society (AMS) online Fireball report form (Hankey et al., 2013, Hankey and Perlerin, 2014) was adapted in 2014 to become an IMO version for a wider audience. During this year, many people helped translate and improve the form. The form now exists in 28 different languages and has been customized for 14 organizations around the world.

Reports

The first report from the IMO fireball report form occurred on February 2nd, 2014. The year 2014 can be considered as a period of tests, therefore we decided to focus only on the period from January 1st, 2015 to August 10th, 2015 for this study. During this period, we received a total of 7100 reports. 93.41% of these reports were reported on the AMS website. The overlap is explained by the fact that the AMS version of the form has been largely publicized since its launch in 2005. Also, the AMS website is optimized for the search engines. As a result, it appears on top of the results of the most popular web, search engines for the queries from English-speaking fireball witnesses (such as “Fireball”, “I saw something like a meteor in the sky”, etc.)

Table 1 – List of abbreviations used in the Fireball Report database. Note that 15 organizations have a customized version of the form but only the following organizations have received reports between Jan. 1st and Aug. 10th 2015.

Abbr.	Organization name
VST	Volkssternwarte Laupheim e.V.
ADO	Astronomsko društvo Orion
AAD	Akademsko astronomsko drustvo - Rijeka
EXO	Exoss Citizen Science
SPA	Society for Popular Astronomy
VSI	Vallende Sterren Info
REF	Réseau Français d'ObseRvation des METéores
UKM	United Kingdom Meteor Observation Network
IMO	International Meteor Organization
AMS	American Meteor Society

Table 2 – Fireball reports by organizations from Jan. 1st, 2015 to Aug. 10th, 2015.

Organization	Reports	%
VST	1	0.01%
ADO	1	0.01%
AAD	2	0.03%
EXO	3	0.04%
SPA	13	0.18%
VSI	59	0.83%
REF	82	1.15%
UKM	123	1.73%
IMO	184	2.59%
AMS	6632	93.41%
Total	7100	

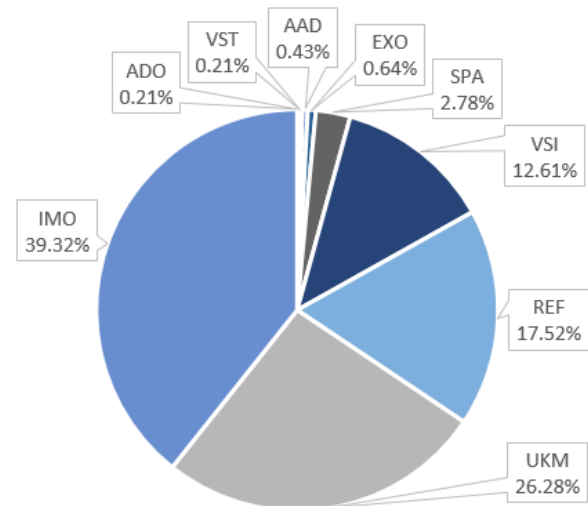


Figure 1 – Fireball reports by organizations from Jan. 1st, 2015 to Aug. 10th, 2015 (excluding the 6632 reports received from the AMS website).

Excluding the AMS website, 468 reports have been received from the IMO version of the form and additional, customized versions. The distribution of the origin of the reports shows the majority were posted from the IMO, the UKM, the REF and the VSI websites (*Table 2* and *Figure 1*).

It is difficult to draw conclusions from these figures, as an important factor is Internet visibility for members of each organization. The figures seem to indicate that the IMO, UKM and REF websites enjoy considerable popularity on the web. Also, the number of reports received by an organization depends on the density of population in its area (as well as the number of fireballs that occurs above this area.)

Events

The 468 reports mentioned in the previous section are grouped into 194 distinct events. 106 of these events associate with only one report. 62 events associate with 2–5 reports, eight with 6–10 reports, and 18 with more than 10 reports.

Table 3 – Number of events and number of events with more than 10 reports associated to each organization. Note: one event may have been posted from more than one version of the fireball form – see *Table 4*.

Organization	Events	Events with 10+ reports
VST	1	0
ADO	1	0
AAD	2	0
EXO	3	0
SPA	9	3
VSI	34	4
UKM	35	4
REF	41	6
IMO	124	18
AMS	1696	105

Table 4– Events with more than 10 reports associated with multiple organizations. Note: all the maps and details for each event can be found at [http://fireballs.imo.net/imo_view/event/2015/\[ID\]](http://fireballs.imo.net/imo_view/event/2015/[ID])

ID	Date	Reports	Organizations	Countries (witness' location at the time of sighting)
657	15/03/2015 19:46	284	AMS (281) - IMO (3)	Luxembourg, Germany, Austria, Switzerland, France
926	18/04/2015 01:12	71	AMS (69) - IMO (2)	USA, Canada
980	21/04/2015 23:15	14	UKM (5) - IMO (3) - VSI (5) - REF (1)	United Kingdom, France, Belgium, Netherlands
982	22/04/2015 02:46	21	AMS (19) - IMO (2)	USA, Canada
1021	26/04/2015 21:02	85	UKM (66) - IMO (12) - SPA (4) - AMS (3)	United Kingdom, Ireland
1037	02/05/2015 01:31	372	AMS (371) - IMO (1)	USA, Canada
1039	02/05/2015 04:32	16	AMS (15) - IMO (1)	USA
1275	06/06/2015 02:01	26	AMS (25) - IMO (1)	USA
1378	22/06/2015 02:18	22	AMS (21) - IMO (1)	USA
1403	25/06/2015 21:15	29	VSI (13) - IMO (7) - UKM (5) - REF (4)	Spain, France, Germany, Belgium, Netherlands, United Kingdom
1420	29/06/2015 05:33	169	AMS (166) - IMO (2) - SPA (1)	USA
1442	30/06/2015 22:45	23	REF (19) - IMO (2) - AMS (1) - VSI (1),	France
1491	09/07/2015 17:03	14	REF (9) - VSI (3) - IMO (2)	France, Belgium
1521	12/07/2015 07:18	31	AMS (30) - IMO (1)	USA
1550	17/07/2015 05:05	17	AMS (16) - IMO (1)	USA
1579	20/07/2015 20:48	12	UKM (4) - AMS (3) - SPA (2) - IMO (2) - REF (1)	United Kingdom, France
1641	26/07/2015 03:09	63	AMS (62) -IMO (1)	USA
1706	01/08/2015 00:47	14	AMS (12) - IMO (2)	USA

The event #2015–1021 (*Figure 2*) occurred on February 26th (UT) between Ireland and the United Kingdom. For this event, the UKM received 66 reports, the IMO received 12 reports, the SPA received 4 reports and the AMS received 3 reports. The fact that the UKM received 16 times more reports than the SPA (while both organizations are located in the UK) is most likely due to poor visibility for where to report a fireball on the homepage of the SPA website (www.popastro.com) while the link to the UKM fireball report form is clearly visible on the UKM homepage (www.ukmeteornetwork.co.uk). Though the SPA website is more popular than the UKM website, the UKM specializes in meteor study so it is more likely to display in search results for to this kind of phenomenon. Also the UKM website is mobile-friendly, which increases site prominence in search results on google.com.

For this event, the comparison between the trajectory obtained from the public report and the trajectory computed by the UKM and other European networks are very close and further validate the accuracy of results obtained from online fireball forms.

It does not look like that customized version of the Fireball form dramatically increased the number of events reported yet (*Table 5* and *Figure 3*). The number of events only increased by 2.36% between the first semester 2014 and the first semester 2015. Events like #2015–980, #2015–1021, #2015–1442 show that European versions of the form are efficient and that witnesses are able to find and use the form properly. However, we only received 10 reports (5 from the AMS website and 5 from the IMO website) for the event #2015–1642 that took place over Argentina. It shows that all versions of the form need to gain in popularity and accessibility throughout the Internet.

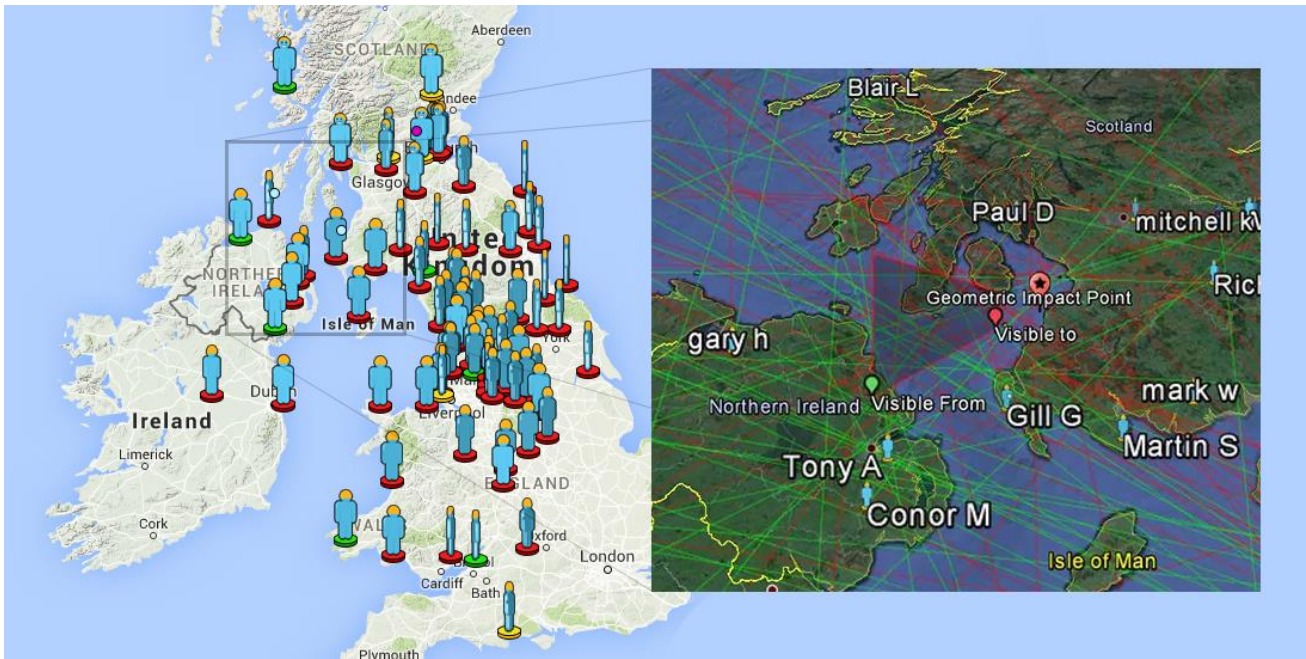


Figure 2 – Witness map of the Event #2015–1021. All the information can be found at fireballs.imo.net/imo_view/event/2015/1021 and www.ukmeteornetwork.co.uk/2015/04/large-fireball-on-26-april-2015-at-2110ut.

Table 5 – Events per number of reports from 2014 to 2015 and comparison between first semester 2014 and first semester 2015.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	1 st Sem. 2014	1 st Sem. 2015	Variation
1 Report	365	357	417	483	453	638	1097	1444	2384	2499	1251	1168	-6.63%
2–5 Reports	75	118	134	182	166	243	405	553	857	918	420	497	+18.33%
6–20 Reports	11	17	15	35	27	39	98	116	231	234	113	153	+35.40%
21–50 Reports	4	1	1	5	4	4	18	21	49	54	20	32	+60.00%
51–100 Reports	0	0	1	0	1	0	6	10	29	24	7	7	-
100+ Reports	0	0	0	0	0	1	1	6	15	21	10	7	-30.00%
Total Events	455	493	568	705	651	925	1625	2150	3565	3750	1821	1864	+2,36%

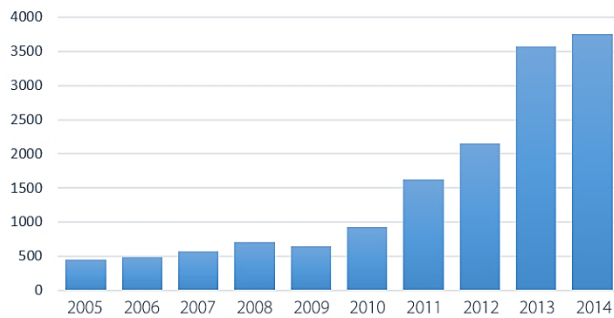


Figure 3 – Events per year between 2005 and 2014.

2 Be popular

As seen in the previous section, popularity and ease-of-access within an organization's website is a crucial to fireball reporting. Increasing the popularity of your website is also a good way to become a source in your country/region/area for everything related to the meteor field. It also ensures greater value of your work as a national or local organization.

Search Engine Optimization

Search engine optimization (SEO) is the process of affecting website visibility in search engines' unpaid results. The leading search engines, such as Google, Bing and Yahoo!, use robots that automatically browse the Internet to find pages for their algorithmic search results. Several techniques can increase your position in such search results:

Web design

Site speed matters in search rankings. Your website must load quickly in a browser, as search ability suffers if users must wait. To prevent poor search ability, reduce the size of images and optimize your code (HTML, CSS and Javascript).

With nearly 40% of organic traffic coming from mobile devices in 2014, it should come as no surprise that mobile-friendly websites will rank better with Google. To ensure your site is optimized for mobile, you should avoid common mistakes described by Google, including faulty redirects, mobile-only 404s, blocked media, etc.

Keywords

Keywords should appear in web page elements such as page title, heading, image *alt* text, and naturally throughout the page copy. You should craft these items for humans, not search engines. In other words, using words and sentences commonly used by fireball witnesses on your site pages, dramatically increases the chance of your site being found in search results.

URL (web address)

A URL is one of the first things a search engine uses to determine page rank, which is why it is important to make your URLs easy to crawl. You can do this by keeping URLs short, aligning to the page's topic and keyword, and ensuring that URLs help you categorize your site pages. For instance, a page www.yourdomain.com/fireball have a much better chance

to be found than www.yourdomain.com/2015-10-08 even if both pages share the same content.

Page titles

The pages of your website contain a HTML tag `<title>`. This tag is used by search engines to display a page in search results and can also be found at the top of your browser. Title tags tell search engines and searchers what the page is about. You need to use a short and meaningful title – put keywords or topics towards the front of the title.

Grow non-paid links

Google continues to use non-paid, quality inbound links as a main ranking factor. The more links direct to your website, the more popular it will be on Google. You should closely monitor inbound links to ensure they are constantly growing and that inbound links originate from quality websites.

User friendliness

Today, with a bigger emphasis on user experience than ever before, user-friendliness will continue to be a critical ranking factor. The easier to use your website is, the more popular it will be. Your website needs to be clear and well-built. Each site action needs to be clearly identified by the visitor.

Social networking and the media

Social Networking – mainly through Facebook and Twitter – dramatically increases the presence of your organization on the web. Having a Facebook page and a Twitter account and updating them regularly with interesting posts, photos and videos helps you build a community and spread the news when a fireball occurs in your area. The more people are aware of your organization, the more reports you can receive when a fireball occurs.

Traditional media outlets are very active on social networks. It is a tremendous asset for your organization to be followed by press companies, weather forecast presenters and popular science communicators. Such entities play a key role in driving traffic to your site, raising awareness on your activities and, of course, informing the general public about celestial events such as fireballs and meteor showers.

Give away stuff

Photos, videos and interesting articles are the best way to attract visitors to your website and increase your community. Goodies are also a nice way to increase general public's interest in our field. In a constant effort to create excitement about science and to increase the level of the general population's knowledge about meteor astronomy, the AMS created an educational poster about Meteor Terminology (Figure 4).

This poster has already been translated in Portuguese Brazilian (by Eduardo P. Santiago for Exoss), in Spanish (by the team of Planetario de Madrid'), in Latvian (by Kārlis Bērziņš for Meteoriti), in Croatian (by Vanesa

Ujčić Ožbolt for Akademsko astronomsko društvo - Rijeka), in German (by Jonas Schenker for Fachgruppe Meteorastronomie) and in French (by Vincent Perlerin and Karl Antier for Réseau Français d'ObseRvation des MEtéores). All language versions of the poster can be downloaded for free on the AMS website¹. We encourage all IMO members to send us the translation of the terms defined in the poster in their own language. Once approved, we will return a PDF of the poster that they will be able to print and share among the community and beyond!

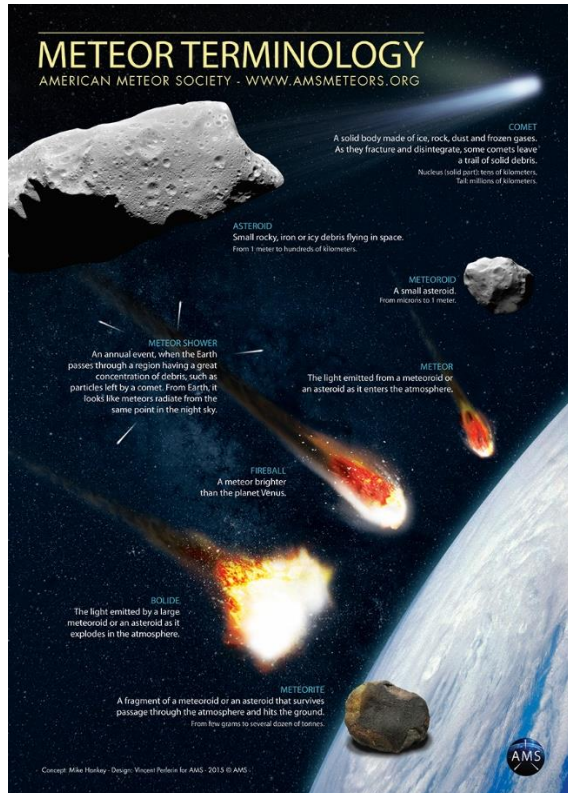


Figure 4 – English version of the American Meteor Society poster “Meteor Terminology”.

3 You don't have your own customized version of the form yet?

The following organizations already have a customized version of the form:

- Akademsko astronomsko društvo - Rijeka
- Astronomsko društvo Orion
- Croatian Meteor Network
- Exoss Citizen Science
- Israeli Astronomy Association
- Réseau Français d'ObseRvation des MEtéores
- Society for Popular Astronomy
- United Kingdom Meteor Observation Network
- Astronomi ve Uzay Bilimleri Gözlemevi Uygulama ve Araştırma Merkezi
- Vallende Sterren Info
- Volkssternwarte Laupheim e.V.
- Vereniging voor Sterrenkunde VVS

- Werkgroep Meteoren van de Koninklijke Nederlandse Vereniging voor Weer- en Sterrenkunde

You can browse all the version from on the IMO website at: fireballs.imo.net/members/imo/translation.

In order to have a custom version of the form, please send the following info to vperlerin@gmail.com:

- default language
- logo (send the largest file available)
- organization full name
- organization abbreviation (if any)
- website url
- Facebook page url (if any)
- Facebook app ID (if any)
- Twitter page url (if any)
- Google analytics UA code (if any)
- List of emails of people who will receive an alert for each new report.

After sending this information, Vincent Perlerin will send you an URL like [fireballs.imo.net/?org=\[Organization Abbreviation\]](http://fireballs.imo.net/?org=[Organization Abbreviation]). It's important for you to use this URL and NOT just fireballs.imo.net.

Get the form in your language

If the form doesn't already exist in your language or if you want to improve an existing translation of the form, you just need to follow the instructions available at fireballs.imo.net/members/imo/translators

4 Conclusion

Any organizations interested in participating in this IMO citizen science project can ask for a customized version of the Fireball report form and participate in the translation of the form if necessary. Promotion of the form and website of all the local organization members of the IMO is crucial to increase awareness from the general public for our field and the quality of the results obtained from the form.

Acknowledgment

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References

- Hankey M., Perlerin V., Lunsford R. and Meisel D. (2013). “American Meteor Society online fireball report”. In Gyssens M., Roggemans P. and Zoladek P., editors, *Proceedings of the International Meteor Conference*, Poznan, Poland, 22-25 August 2013. IMO, pages 115–119.
- Hankey M. and Perlerin V. (2014). “IMO Fireball Reports”. In Rault J.-L., and Roggemans P., editors, *Proceedings of the International Meteor Conference*, Giron, France, 18–21 September 2014. IMO, pages 160–162.

¹ www.amsmeteors.org/resources/posters