

Let's Agree on the Casing of Lidar

Is it lidar, Lidar, LiDAR, LIDAR, LiDar, LiDaR, or liDAR? A comprehensive review of the scientific/technical literature reveals seven different casings of this short form for light detection and ranging. And there could be more.

Science moves forward on the wheels of precision and clarity, but the exactitude of research cannot be communicated without an accompanying exactitude in language. In chapter 1 of *Writing Science in Plain English* (2013), Anne E. Greene writes that “many journal editors and senior scientists believe that unclear scientific writing is a serious problem” and that some of them even think poor scientific writing impedes scientific progress. Greene’s

short guide focuses on the structure of clear, concise prose in the communication of clear and precise science. But attention to the mechanics of technical language is also important. Precision, consistency, and clarity are part and parcel of good science. Therefore, it is our opinion based on a thorough review of the literature, in combination with observed uses of other similar acronyms, that the acronym for light detection and ranging technology should be lowercase: lidar.

Rules of Usage

Acronyms, words created from the initial letters of other words, or the initial letters and syllables of other words, were first

formally recognized in the scholarly literature in 1943, though like other types of abbreviations, acronyms had in fact been used for centuries. But the 20th century and WWII in particular pushed forward the use of acronyms. Post-war special dictionaries of abbreviations and acronyms specific to languages, regions, countries, and fields of study documented the growing importance of shortened forms in the United States and elsewhere. To ensure clarity in written and spoken exchange, agreed upon rules of usage are critical. Thus, the various dictionaries of abbreviations and acronyms not only chronicled the reliance on word-compression but also provided guidance about spelling and casing.

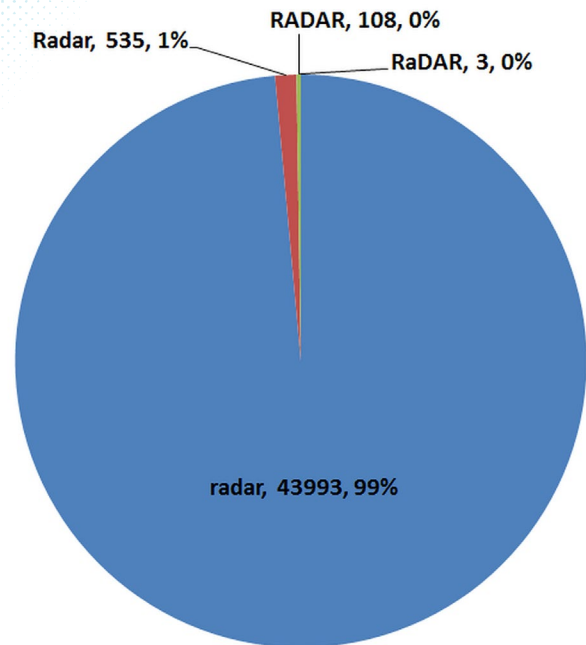


Figure 1: Casings for “radio detection and ranging.”

BY CAROL A. DEERING, JASON M. STOKER

Ralph de Sola published the first edition of his internationally respected *Abbreviations Dictionary* in 1958. “Short forms,” wrote de Sola in the foreword, “usually follow the capitalization of the words they stand for, although this is not a fast rule.” He noted that as people become accustomed to new words and concepts, “capital letters drop to initial capitals and finally to lower case.” Now in its tenth edition, the *Abbreviations Dictionary* continues to advise in its foreword that while acronyms generally are capitalized, that is not so with common nouns. “At first loran was LORAN. As people became more used to it, it became Loran. Today it is loran. The same is true of other combinations. The trend is to capitalize only those letters standing for proper nouns, running all common nouns in lowercase.”

Contemporary style manuals give similar advice on acronym casing. The 16th edition of the esteemed *Chicago Manual of Style* notes in its overview on abbreviations that “with frequent use... acronyms—especially those of five or more letters—will sometimes become lowercase.” In *Scientific Style and Format (7th ed.)*, the Council of Science Editors (CSE) writes in its chapter on abbreviations that some acronyms “eventually cease to be capitalized (e.g., laser for light amplification by stimulated emission of radiation), but that is not the case for organization names (e.g., NASA for National Aeronautics and Space Administration).” The online *Mayfield Handbook of Technical & Scientific Writing* explains similarly in its section on acronyms that they should be capitalized, but when they “become integrated into the language as common nouns (for example, laser, radar, or scuba), they are no longer capitalized.”

Methods

We conducted searches of four literature indexes—Scopus, Web of Science, Current Contents Connect, GeoRef—for instances of the acronym lidar in the abstract field of publication records. The abstract field was selected for review because the text in that field typically retains the capitalization and punctuation as written by the author(s), while the title and keyword fields can be variously cased by the indexer. In Scopus we limited the search to the abstract field and then exported the records into an EndNote library. In Web of Science, Current Contents Connect, and GeoRef, we could not limit the search to the abstract field, so we searched for lidar in all metadata fields, exported the resulting records to EndNote, removed all records that did not include an abstract, and then removed from the remaining records all those that did not include lidar in the abstract. We left the search open to the full date range offered in each of the indexes—Current Contents Connect, 1998-present; GeoRef, 1693-present; Scopus, 1823-present; and Web of Science, 1985-present.

Once all records were in an EndNote library, we prepared the database for analysis. We removed duplicate records, records with an abstract in all uppercase letters, false hits (e.g., Lidar as a personal name mentioned in the abstract), and records describing whole conference proceedings. Using EndNote’s match case and match word search functions, we then searched the remaining records for nine different casings of the acronym lidar: lidar, Lidar, LiDAR, LIDAR, LiDaR, LiDar, LiDaR, LIdar, and liDAR.

We set up each search to find the targeted casing of lidar while simultaneously eliminating all other

casings and then grouped the results from each search into a unique folder. Records were found for seven of the nine casings: lidar, Lidar, LiDAR, LIDAR, LiDaR, LiDar, and liDAR. No instances of LiDAR or LIdar were found. Some records included more than one casing of lidar, so we put those into an “undetermined” group.

We then used EndNote’s powerful search capabilities as well as manual review to check records in each of the groups and eliminate those for which we could not determine casing because the acronym was used only at the beginning of sentences and/or only within proper nouns. For example, if an abstract in the Lidar group included the acronym only at the beginning of a sentence and/or only as part of a proper noun, we eliminated the abstract from the data set. We also performed similar searches for the various casings of radar (radio detection and ranging), as well as sonar (sound navigation and ranging), assuming these were analogs to our question about lidar and light detection and ranging.

Results

In general, writing guides agree on the casing of many widely used acronyms that are now considered common nouns, such as radar, loran, sonar, and laser. A review of abstracts in the scientific/technical literature, moreover, reveals that authors typically follow the published advice when casing coined words that have become common nouns. The short form for radio detection and ranging is lowercased as radar in 99% of the 44,639 abstracts examined. Other casings, Radar, RADAR, and RaDAR, are used in only 1% of the abstracts (**Figure 1**). Similarly,

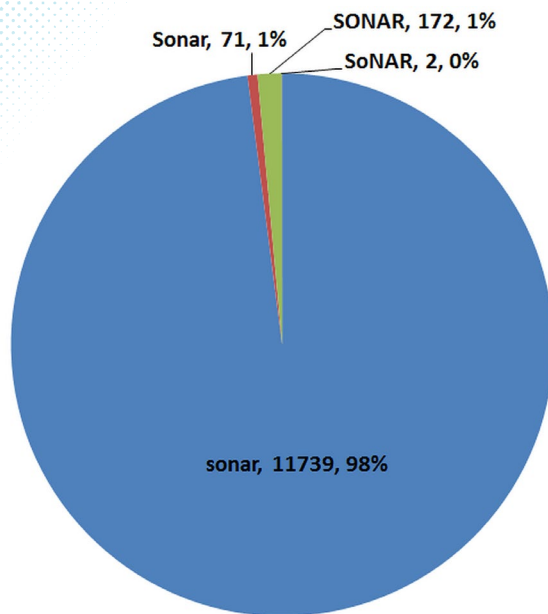


Figure 2: Casings for “sound navigation and ranging.”

the acronym for sound navigation and ranging is cased as sonar in 98% of the 11,984 abstracts reviewed, and other casings, Sonar, SONAR, and SoNAR, can be found in just 2% of the abstracts (Figure 2).

Authors do not agree so readily, however, on the acronym for light detection and ranging. About two-thirds (65%) of the 16,129 abstracts reviewed lowercased the acronym lidar. Six additional casings are found in the other 35% of abstracts. Three of those casings, LiDar, LiDaR, and liDAR, are included in just seven abstracts, a small fraction not even approaching 1%. The other three casings, Lidar, LIDAR, and LiDAR, at 4%, 17%, and 14%, respectively, comprise the rest of the 35% of the abstracts that do not fall into the lowercased lidar category (Figure 3).

Why such inconsistency in the casing of lidar for light detection and ranging compared to radar for radio

detection and ranging or sonar for sound navigation and ranging? Lidar and LIDAR have been used since the early days of the technology in the 1960s, when it was being developed to measure atmospheric composition and aerosols. The casing LiDAR, however, did not appear until the late 1990s. The first instances we found were in a 1998 conference paper discussing [digital elevation models](#), and in a 1999 conference paper describing “[airborne scanning laser altimetry \(LiDAR\)](#)” as newly important in environmental applications. Similarly, the first instances in the journal literature were in 2000, in papers discussing the [derivation of crop height](#), [beach topography mapping](#), and the [extraction of surface features](#).

Light detection and ranging technology has been developed, studied, and used over the past five decades by multiple disciplines. Its applications are wide-ranging and continue to grow. Is

a specific casing more likely associated with a particular discipline? Or specific uses within a discipline? Was the appearance of LiDAR in the late 1990s an effort by researchers to distinguish from earlier applications their newly developing use of the technology in earth and vegetation mapping? Interesting questions, but beyond the scope of this piece, and really of no consequence to the important point being made here: no matter the discipline using light detection and ranging technology, no matter the application of the technology, the technology is the same—pulses of laser light are used to measure distance. Researchers need to agree on a label that reflects that fact.

Discussion

Unlike acronyms created from agreed-upon and unchanging labels for the respective technologies—radar for radio detection and ranging, and sonar for sound navigation and ranging—lidar has been used, and variously cased, as a shortened form for a variety of multi-word descriptions of the light detection and ranging technology. Over the years, light detection and ranging technology has been termed laser radar, light radar, light detection and radar, aerial laser scanning, airborne laser altimetry, and more. Perhaps, then, the lack of agreement on the casing of lidar has been inevitable given that researchers have not even agreed upon what the technology itself should be called.

Does the lack of consensus on the casing of lidar matter? Yes. Inconsistent casing of the acronym lidar can lead to confusion. Most common-noun acronyms like lidar (radar and sonar) are typically lowercase, and the lack of consensus threatens the clear, precise

communication of often complex scientific and technical concepts. If acronyms for other multi-word common-noun combinations are consistently cased, while lidar is not, readers may reasonably believe that the different casings indicate completely different technologies. This becomes even more probable when you consider that light detection and ranging technology is used in diverse applications and fields.

Most advice about scientific writing focuses on sentence simplicity and clarity and precise word choice. Discussion that is difficult to follow because the writing is difficult to follow leads to confusion. Word choice is important for the same reason: ambiguous words, words without precision, confound rather than clarify scientific discourse. It goes without saying that spelling must be correct so that messages are not obscured. Rules of punctuation must be followed. The details of writing do matter. Clear communication demands attention to the details of communication. And that includes attention to the mechanics of technical language. Writing conventions lock in consistency, with an aim toward clarity. When conventions are followed, readers don't have to stop and ask "what do you mean?" Within the Department of the Interior, DOI stands for something quite different than another common acronym in science, the doi, or digital object identifier. The casing makes all the difference.

Conclusion

Why choose the lowercasing of lidar to describe light detection and ranging? First, style manuals and other writing guides advise that acronyms used as common nouns should be lowercased.

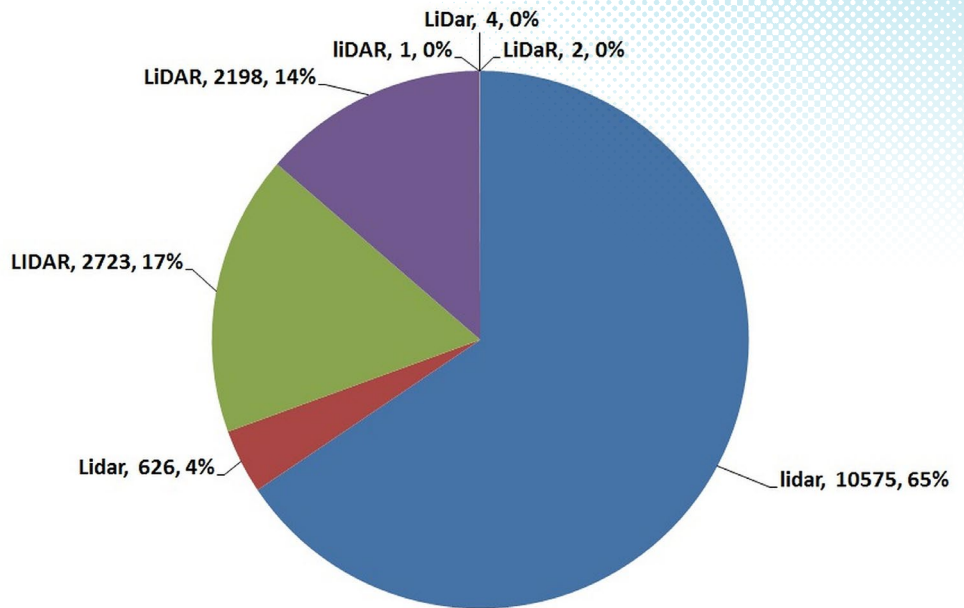


Figure 3: Casings for "light detection and ranging."

The acronym lidar falls into this category. Second, lidar is lowercased in two-thirds of the abstracts reviewed that discuss light detection and ranging technology. Clearly the trend among authors is to follow the published guidance about usage. Third, authors who first wrote about the developing technology in the 1960s used lidar. Goyer and Watson (*Bulletin of the American Meteorological Society*, v. 44, no. 9, 1963) and Ring (*New Scientist*, v. 344, 1963) were the first to use the acronym in the journal literature, and they chose the lowercasing.

But history weighs even heavier on the side of lowercasing. In 1953, Middleton and Spilhaus were the first researchers to coin the term lidar to describe a light-ranging technology that was being conceived in Europe. Ten years before the mention of lidar

in the journal literature, they wrote on page 208 of *Meteorological Instruments (3rd ed., rev.)* that "experimental devices using a pulse of light—'lidar' so to speak—have been made in France and in Great Britain." Perhaps the last word on the casing of lidar should be given to those who gave us the first word. ■

Carol Deering (MA, MLS), librarian at USGS EROS, facilitates information discovery, access, and management for Center research and applications staff. She is employed by ERT, Inc., a contractor to the US Geological Survey.

Jason Stoker is a Supervisory Physical Scientist at the US Geological Survey. Jason is currently the Acting Elevation Product and Service lead for the National Geospatial Program at USGS Headquarters, Team Lead for the Topographic Sciences team at USGS EROS, and the Project Manager for the EROS Lidar Science Project.