

**CONFRONTING NELOS:
CROSS-EXAMINING THE CELLPHONE
INDUSTRY’S SECRET LOCATION TECHNOLOGY**

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ABSTRACT

Telecommunications companies have proprietary technology they claim allows them to precisely locate a cellphone. This technology has been admitted as evidence in criminal trials across the country. However, a closer look at this technology reveals that it may have flaws that make it unreliable and inadmissible. And, even if the technology performs as expected, it still does not meet either the *Daubert* or *Frye* standards for admissibility because the proprietary nature of the technology does not allow for evaluation of whether it was reliably applied in a given case.

The burden rests on the proponent to establish evidence is admissible at trial by a preponderance of the evidence. Federal Rule of Evidence 702(c)–(d) prohibits expert testimony based on scientific methodologies that are not reliable or have not been reliably applied. *Daubert* created a two-prong test for how to evaluate reliability: first, review the scientific method for valid scientific reasoning using several factors; and second, to establish the scientific method has been

reliably applied to the facts in that specific case. The proprietary technology cannot meet most of the first-prong *Daubert* factors because self-claiming a technique is generally accepted does not prove by a preponderance of the evidence that the technique is scientifically valid. It is unclear if this proprietary cellphone technology has been tested or peer-reviewed. And the technology was developed for a purpose other than what it is being used for. Lastly, even though opponent of the evidence does not bear the burden of proof, because the technique cannot be cross-examined by the opponent it cannot meet the reliably applied standards required by *Daubert*.

The *Frye* standard similarly deems this technology inadmissible because the proponent cannot establish the technology as accepted in the general scientific community. This technology closely parallels the facts of the original *Frye* decision. The underlying application of the technology was accepted by the scientific community, but the newer hypothesis based on the underlying technology has not been accepted, and it is thus inadmissible.

Therefore, because this technology does not meet the *Daubert* or *Frye* standards for being a reliable science, this technology should not be admitted as evidence.

INTRODUCTION

Nine-out-of-ten Americans own a cellphone.¹ They are our constant link to the world, but they are also tracking devices we keep in our pockets. For a person accused of a crime, cellphone location evidence can be some of the most damning evidence. It is an intimate accuser, one who knows you better than your spouse or family.² And cellphone companies are getting better at knowing exactly where you are. Cellphone companies purport to have newer technology that knows exactly where your phone is, where you are while carrying it, to within a few meters even without the GPS active.³ Cellphone technology has become so advanced that it borders on mystical, but

1. LEE RAINIE & KATHRYN ZICKUHR, AMERICANS' VIEWS ON MOBILE ETIQUETTE 10 (2015) (available at https://www.pewresearch.org/wp-content/uploads/sites/9/2015/08/2015-08-26_mobile-etiquette_FINAL.pdf).

2. *See* *Carpenter v. United States*, 138 S. Ct. 2206, 2218 (2018) (indicating that individuals carry cellphones with them compulsively, that cellphones have almost become a “feature of human anatomy,” that most cellphone users are rarely more than five feet away from their phones, and that twelve percent of users even have their phones in the shower (quoting *Riley v. Cal.*, 573 U.S. 373, 385, 395 (2014))).

3. *See id.* at 2219.

what if it is wrong? How does one refute the ever-present eye-in-the-sky?⁴

Imagine you are accused of a crime, but the technology used to accuse you is a secret. You cannot refute it, and you cannot test it. This is the reality for people facing prosecutions every day. And the technology is not always even accurate. In 2019, thirty-two prisoners in Denmark were released from prison because of flawed geolocation data used to convict them obtained from their cellphones.⁵ After a review of cases, police there discovered that there were errors in the software that converts the software from the cell tower to usable records.⁶ And nearly forty more cases needed to be postponed to evaluate the veracity of their cellphone location records.⁷

Per Call Measurement Data (PCMD) is proprietary cellphone location technology known as Round Trip Delay (RTD).⁸ The technology purportedly is able to locate cellphones with more accuracy than the traditional cell tower triangulation method.⁹ However because the three major U.S. cellphone communications companies refuse to disclose how the technology works¹⁰, it should not be admitted as evidence in court. Even though this note argues that PCMD meets neither the *Daubert* nor *Frye* standards, PCMD location data is being admitted in several jurisdictions throughout the country.¹¹ And of equal, if not greater, concern is that this technology

4. Note that although cellphone location data is often used by the prosecution, it can and has been used by the defense to attempt to prove a client was not at the scene of a crime. See Kashmir Hill, *Imagine Being on Trial. With Exonerating Evidence Trapped on Your Phone.*, N.Y. TIMES (Nov. 22, 2019), <https://www.nytimes.com/2019/11/22/business/law-enforcement-public-defender-technology-gap.html> (explaining the trouble defense attorneys have obtaining access to the same cellphone location records as prosecuting attorneys).

5. See Jon Henley, *Denmark Frees 32 Inmates Over Flaws in Phone Geolocation Evidence*, THE GUARDIAN (Sept. 12, 2019, 6:13 AM), <https://www.theguardian.com/world/2019/sep/12/denmark-frees-32-inmates-over-flawed-geolocation-revelations>.

6. See *id.*

7. See *id.*

8. See LARRY DANIEL, CELL PHONE LOCATION EVIDENCE FOR LEGAL PROFESSIONALS: UNDERSTANDING CELL PHONE LOCATION EVIDENCE FROM THE WARRANT TO THE COURTROOM 81 (2017).

9. See *id.* at 86.

10. See discussion *infra*.

11. See *United States v. Freeman*, No. 2:20-cr-20164-JTF-cgc, 2021 U.S. Dist. LEXIS 92411, at *12–14 (W.D. Tenn. Mar. 30, 2021) (defendant appears not to have raised a *Daubert* challenge); *Alaska v. Johnson*, No. 3PA-16-02603CR (D. Alaska Aug. 3, 2018); *People v. Fletcher*, No. B302780, 2021 Cal. App. Unpub. LEXIS 1737, at *12 (Cal. Ct. App. Mar. 17, 2021); *Browning v. State*, No. 19A-CR-2522,

has been shown to contain enormous errors.¹² It has located suspects' phones far into the ocean.¹³ It has indicated that a phone is in one location and within seconds that phone jumped to an impossibly distant location.¹⁴ Unless and until this technology is publicly disclosed and proven to be reliable, it should not be used as evidence.

For the sake of clarity, this note will focus on PCMD technology used by AT&T called Network Event Location System (NELOS).¹⁵ NELOS isn't the only PCMD technology in use by large telecommunications companies.¹⁶ Verizon uses a process called Range to Tower (RTT) and T-Mobile uses TrueCall or Timing Advance (TA).¹⁷ Focusing on NELOS and AT&T instead of addressing all three providers serves as a case-study with broader implications across the telecommunications industry. All major cellphone carriers use similar technology and processes; all major cellphone companies similarly will not release information about their proprietary technologies therefore NELOS is broadly representative of PCMD technologies.¹⁸ The conclusions of this Note surrounding NELOS further apply to proprietary technologies' inadmissibility in general.

2020 Ind. App. Unpub. LEXIS 959, at *23–25 (Ind. Ct. App. Aug. 6, 2020); *State v. Lynn*, 251 So. 3d 1262, 1270 (La. Ct. App. 2018); *Holland v. State*, No.2382, 2019 Md. App. LEXIS 501, at *5–8 (Md. Ct. Spec. App. June 20, 2019); *People v. Grant*, No. 338615, 2019 Mich. App. LEXIS 7465, at *7 (Mich. Ct. App. Nov. 26, 2019); *State v. Ford*, 454 S.W.3d 407, 414 (Mo. Ct. App. 2015); *People v. Owen*, No. 236N-20, 2021 NYLJ LEXIS 128, at *1 (N.Y. Sup. Ct. Mar. 1 2021); *Commonwealth v. Morales*, No. CF-36-CR-0001430-2015, 2016 Pa. Dist. & Cnty. Dec. LEXIS 15533, at *13–14 (C.P. Ct. Sept. 2, 2016); *State v. Rhodes*, No. 2019-UP-361, 2019 S.C. App. Unpub. LEXIS 353, at *9 (S.C. Ct. App. Nov. 6, 2019); *State v. Villanueva*, No. 36694-4-III, 2020 Wash. App. LEXIS 3290, at *38 (Wash. Ct. App. Dec. 17, 2020).

12. See E-mail from Mark Pfoff, Rocky Mountain Comput. Forensics, to author (Dec. 30, 2021, 06:38pm PST) (on file with author).

13. See *id.*

14. See *id.*

15. See U.S. Patent Application No. 2012/0052883 A1 at [1] (filed Aug. 27, 2010) [hereinafter A&T Patent Application]; U.S. Patent No. 8,447,328 B2 (filed Aug. 27, 2010) (issued May 21, 2013) [hereinafter AT&T Patent].

16. Richard Miletic, *Column: Cellphone Forensics*, 45 CHAMPION 48, 50 (2021); *Holland*, 2019 Md. App. LEXIS 501 at *5–6 (discussing Verizon Real Time Tool and its basis on round trip delay).

17. See Miletic, *supra* note 16, at 50; *In re Search of a Cellular, Telephone _____, Cellular, Number _____*, 430 F. Supp. 3d 1264, 1268 (D. Utah 2019).

18. See Miletic, *supra* note 16, at 50.

This note proceeds in three parts.¹⁹ Part I establishes the background of cellphone location technologies. Part II explains what we know about NELOS technology and what is unknown about NELOS technology. Part III explores the technology's failure to meet the *Daubert* or *Frye* standards and other evidentiary questions.

I. THE BACKGROUND OF CELLPHONE LOCATION TECHNOLOGY

It is important to discuss the background of cellphone location technology generally because lawyers and judges lag in in-depth understanding of technology—even as that technology becomes more integrated into the field of law.²⁰ Current cases show judges tend to misunderstand PCMD technology and other cellphone location technologies; therefore, a brief overview of cellphone location technologies is appropriate.²¹

There are two primary forms of cellphone location technology. One uses a known phone number and attempts to locate where that phone has traveled.²² The other is a reverse method by taking a known cell tower location and determining all cellphones that have traveled through that location.²³ Both forms are discussed here to better understand the cellphone location technologies and their capabilities; however, NELOS technology is a product of the first form of technology: attempting to locate a targeted cellphone.

A. *Methods of Determining a Cellphone's Location*

Splitting the discussion of cellphone location technology into two parts, the first technologies discussed are those that use a known phone to find where that phone is currently or has been historically.

19. Although not specifically addressed in this Note, because of the non-testimonial nature of third-party records, there is a broader constitutional due process argument that can be made based on the Sixth Amendment. There is nuance between not being able to challenge the records themselves, and not being able to even test the evidence presented against an accused which may violate the right to confront one's accusers. This topic requires further exploration by the legal community.

20. Marcello Gaboardi, *How Judges Can Think: The Use of the Expert's Knowledge as Proof in Civil Proceedings*, 18 GLOB. JURIST 1, 18 (2018).

21. See *State v. Villanueva*, No. 36694-4-III, 2020 Wash. App. LEXIS 3290, at *36–38 (Wash. Ct. App. Dec. 17, 2020) *review denied sub nom.* *State v. Mendez Villanueva*, No. 99439-1, 2021 Wash. LEXIS 233 (2021) (comparing NELOS directly to prior forms of CSLI).

22. See *United States v. Temple*, No. S1-4:15 CR 230-1 JAR, 2017 U.S. Dist. LEXIS 218638, at *81–82 (E.D. Mo. Oct. 6, 2017).

23. See *id.*

1. Pen Registers and Trap and Trace Devices

Pen register devices are addressed first on the list of technologies because they are the oldest chronologically. A pen register “records or decodes dialing, routing, addressing, or signaling information . . .”²⁴ Essentially, law enforcement used pen registers to tap into a telephone wire to determine what number was being called, and the technology is now used wirelessly.²⁵ A trap and trace device, as the flip side of the coin, records the incoming call information.²⁶ As such, pen registers and trap and trace devices have evolved to work in obtaining cellphone data. Use of these devices requires a court order.²⁷ These types of devices allow law enforcement to access real-time cellphone locations pursuant to a court order because they will record which towers are actively in use during a call.²⁸

2. Pinging

Pinging is the process where law enforcement or the telecommunication system attempt to locate a cellphone.²⁹ The provider forces a signal to be sent to the phone to cause the cellphone to reveal its location to a nearby cell tower.³⁰ Since pinging is a real-time system used to locate the phone for 911 emergencies³¹ or to track a suspected kidnapper, it can be very exact, but is generally not available in the ordinary course of business records.³² This type of data is provided to the requester in terms of latitude and longitude with an estimated margin of error.³³

3. Global Positioning System (GPS)

Transitioning from the active location of a known phone into the historical location of a known phone, cellphone GPS is technology

24. Pen Register Act, 18 U.S.C. § 3127(3) (2022).

25. *See id.*

26. *See id.* § 3127(4).

27. *See id.* § 3121(a).

28. SCIENTIFIC WORKING GROUP ON DIGITAL EVIDENCE, SWGDE RECOMMENDATIONS FOR CELL SITE ANALYSIS 8 (2017) (available at <https://drive.google.com/file/d/15SicGOefoPJtNbVi8PDsfc1fZQBHmJld/view>) [hereinafter SWGDE].

29. *See id.* at 13.

30. Brief of Technology Experts as Amici Curiae Supporting Petitioner, *Carpenter v. United States*, 138 S. Ct. 2206 (2017) (No. 16-402), 2017 U.S. S. Ct. Briefs LEXIS 2850, at *14–15 [hereinafter Technology Experts Amici Brief].

31. *See* AT&T Patent, *supra* note 15.

32. *See* SWGDE, *supra* note 28, at 5, 13.

33. *See id.* at 13.

that can accurately locate that cellphone with a high level of precision.³⁴ GPS can measure the location of a cellphone to within fifteen feet.³⁵ But GPS tracking is a feature that generally has to be turned on by the user, such as running a location-based application.³⁶ GPS is limited by the phone's ability to receive a signal from a satellite (i.e. not in a big building or underground).³⁷

4. Cell Site Location Information (CSLI) and Call Detail Records (CDR)

A cell site is another name for a cell tower. The terms are interchangeable, although a cell site is "comprised of the equipment needed to receive and transmit radio signals for cellular voice and data transmission[s]," and a cell tower is technically the physical tower upon which the equipment sits.³⁸

CSLI and CDR are almost interchangeable terms, but there is a slight difference. CSLI is a record summarizing all the information various technologies collect when a cellphone communicates to a cell tower and back.³⁹ This includes the location of the tower.⁴⁰ Cellphone carriers collect and store CSLI for their own purposes to help improve their network coverage or bill customers.⁴¹

CDR is also a record summary. Providers keep it to bill a customer including the "date, time, duration, source identifier, destination identifier, or, the amount of data transmitted or received."⁴² Thus, the CDR may contain the historical cell site location information such as what tower the cellphone connected to and how long the call lasted when connected to that tower.⁴³ CSLI includes CDR data and the physical cell tower location information a phone connected to.⁴⁴

34. See *Carpenter v. United States*, 138 S. Ct. 2206, 2219 (2018).

35. See *id.* at 2225.

36. See Technology Experts Amici Brief, *supra* note 30, at *20

37. See *id.* at *15

38. SGWDE, *supra* note 28, at 18, 21.

39. See STEPHANIE LACAMBRA, CELL PHONE LOCATION TRACKING OR CSLI: A GUIDE FOR CRIMINAL DEFENSE ATTORNEYS 1 (Oct. 30, 2017) https://www.eff.org/files/2017/10/30/cell_phone_location_information_one_pager_0.pdf.

40. See DANIEL, *supra* note 8, at 36.

41. See *Carpenter v. United States*, 138 S. Ct. 2206, 2212 (2018).

42. SGWDE, *supra* note 28, at 18.

43. See Miletic, *supra* note 16, at 50.

44. See DANIEL, *supra* note 8, at 30.

Carriers create CDR and CSLI when the phone is in active interaction with a cell tower.⁴⁵ Phones are designed to be perpetually within range of a cell tower, and those data records may be even more useful at ascertaining the historical location of a cellphone than any other method, but the network location transmissions without the cellphone being used are generally only kept for a short period of time.⁴⁶ However, CDR and CSLI data is created when a phone is making a call, transmitting a text, or transmitting other data.⁴⁷ Therefore, it is a more voluntary process than just having the phone in one's pocket or purse, but still creates an in depth log of activity that is kept for a long period of time.

For purposes of locating a phone historically, CDR and CSLI will identify the cell tower being accessed by a cellphone at any given time. CDR and CSLI records do not actually locate a cellphone itself. The records locate the tower or towers a cellphone has used.⁴⁸ Telecommunications providers maintain these records routinely for several years.⁴⁹

5. *Triangulating*

The information on CSLI and CRD records can be extrapolated to triangulate a cellphone's location.⁵⁰ Triangulation is the process of identifying which tower or towers a cellphone has accessed and obtaining an estimate of those towers' ranges in order to create overlapping circles of possible locations.⁵¹ (See Figures 1 & 2).

Cell sites can have different kinds of equipment. Some cell sites use antennas oriented to cover 360-degrees of range, while other cell sites have directional antennas that cover 120-degrees⁵² or even 60-degrees.⁵³ (See Figure 3 & 4). Cell towers can reach approximately a half-mile to two miles in city locations.⁵⁴ The density of cell towers in

45. See Technology Experts Amici Brief, *supra* note 30, at *14.

46. See *Carpenter*, 138 S. Ct. at 2211–12; DANIEL, *supra* note 8, at 60.

47. See DANIEL, *supra* note 8, at 60.

48. See Miletic, *supra* note 16, at 50.

49. See Technology Experts Amici Brief, *supra* note 30, at *9.

50. See Brief for Electronic Frontier Foundation et al. as Amici Curiae Supporting Petitioner, *Carpenter v. United States*, 138 S. Ct. 2206 (2018) (No. 16-402), 2016 U.S. S. Ct. Briefs LEXIS 3952, at *20.

51. See *How GPS, Cell Tower and Wi-Fi Triangulation Help in Tracking Location?*, SAFETRAX, <https://www.safetrax.in/how-gps-cell-tower-and-wi-fi-triangulation-help-in-tracking-location> (last visited Sep. 20, 2022).

52. See SGWDE, *supra* note 28, at 9.

53. See *Carpenter v. United States*, 138 S. Ct. 2206, 2224 (2018).

54. See *id.*

a particular area is highly important in triangulation.⁵⁵ Since density and signal strength is critical in city areas, there are more cell towers in that area.⁵⁶ Hence, it is common that in a city a cellphone could be located to an area of a dozen blocks, whereas in a rural area location data may be up to forty times more inaccurate.⁵⁷

There is a degree of speculation in triangulation methods. Cell site ranges are only estimates.⁵⁸ Further, radio signals emitted from a cellphone may be reflected causing them to reach towers they otherwise would not be within range of.⁵⁹ This can cause known inaccuracies in the triangulation method; however, cellular providers test their equipment for the range of their radio frequency signals in the ordinary course of their business.⁶⁰ And, of course, a cell site's range does not extend in a neat sphere as shown on most triangulation maps.⁶¹

B. Method of Determining Which Cellphones Used a Particular Tower

The technologies above identified the mechanics used to track the location of a specific phone. The technologies discussed below are based on the known location of the tower and whether a phone is using a specific tower (i.e. investigators want to obtain the phone numbers of all cellphones connecting to a specific cell tower).

1. Stingrays and Cell Site Simulators (Pen Registers and Trap and Trace Devices)

Pen registers and trap and trace devices, as noted above, are used to intercept the numbers dialed between phones. They are types of equipment that can be attached by a law enforcement surveillance team to intercept particular cellphone signals traveling through a

55. See Technology Experts Amici Brief, *supra* note 30, at *15.

56. See *id.* at *13.

57. See *id.*

58. See SWGDE, *supra* note 28, at 20 (indicating that optimal beamwidth as reported by a cellular phone provider reflects only a best-case scenario and may not reflect the true entirety of a cell site's coverage area).

59. See DANIEL, *supra* note 8, at 66.

60. See SGWDE, *supra* note 28, at 20–21 (indicating testing methods such as Radio Frequency Surveys and Walk Tests to verify the range of signal in a particular area).

61. See DANIEL, *supra* note 8, at 49–57 (arguing that non-expert witnesses routinely present misleading maps that have been overly simplified).

particular tower.⁶² Similarly, Stingrays, otherwise known as “cell site simulators” or “IMSI,” are devices that simulate a cell site and instead capture the information from phones in a nearby area.⁶³ They are, in essence, a fake cellphone tower, and the cellphones connect through them before the signal transmits to its final destination.⁶⁴ Law enforcement agencies use Stingrays throughout the country, but they are controversial because they capture the cellphone data on anyone in the area, not just a suspect.⁶⁵

2. Tower Dumps

A “tower dump” is a collection of all the CSLI data associated with a particular cell site.⁶⁶ Sometimes tower dumps are referred to as historical CSLI. Tower dumps, while not being real-time requests, are similar to stingray devices in the fact that they reveal all the users within a particular location on a specific day at any given time.⁶⁷ For example, in *Carpenter v. United States*, the suspects were accused of robbing a series of Radio Shacks and police obtained the historical CSLI information to determine which phones were near all the robbery locations.⁶⁸

II. WHAT IS KNOWN AND UNKNOWN ABOUT NELOS TECHNOLOGY

As described above, there are various methods of robust cellphone location technology. Therefore, it is important to distinguish how the Network Event Location System (NELOS) technology from AT&T fits into cellphone location. As a reminder, this note discusses NELOS technology as a representative case-study that has broader implications for all types of Per-Call Measurement Data technology used by other telecommunications providers. It can also serve as a case-study for other non-cellphone, proprietary technologies.

The use of NELOS and PCMD technologies, in particular, provide greater concerns of inaccuracy when compared to other

62. See SWGDE, *supra* note 28, at 20.

63. See *Stingray Tracking Devices*, AM. CIV. LIBERTIES UNION (Dec. 14, 2018), <https://www.aclu.org/issues/privacy-technology/surveillance-technologies/stingray-tracking-devices>.

64. See *id.*

65. See *id.*

66. See *Carpenter v. United States*, 138 S. Ct. 2206, 2220 (2018).

67. See *id.*

68. See *id.* at 2212. Although this note doesn't address the topic of privacy, the Supreme Court in *Carpenter* emphasized that it was not expressing a view on whether real-time CSLI or “tower dumps” were constitutional. See *id.* at 2220.

cellphone location methods.⁶⁹ Call Detail Records (CDR) only provide the location for the cell tower the phone was accessing during a call, text, or other data transmission. PCMD records provide an actual estimate of the targeted phone's location.⁷⁰

AT&T and other carriers created NELOS and PCMD in order to attempt to locate a phone without GPS.⁷¹ But the purpose of development was to provide additional services to the user and to ensure the cell tower network was providing sufficient coverage.⁷² AT&T and other carriers did not create NELOS and PCMD to historically locate a user for investigative purposes, and they do not test the technologies for that purpose.⁷³

A. What is NELOS Technology

Not much is known about NELOS technology specifically.⁷⁴ NELOS is proprietary technology,⁷⁵ and AT&T does not publicly release the scientific methods and techniques used to create the location system⁷⁶ except identifying some parts of the technology in patent filings.⁷⁷ But some discussion of the underlying technologies used in NELOS can be extrapolated based on how NELOS functions and the limited information released by AT&T.

Radio Frequency (RF) waves are electromagnetic pulses.⁷⁸ These pulses travel at the speed of light in a vacuum.⁷⁹ Round Trip Delay (RTD) technologies such as NELOS claim to be able to measure the time it takes for these electromagnetic pulses to go from the cellphone

69. See Miletic, *supra* note 16, at 50 (stating that PCMD calculations do not use GPS or E911 technologies and therefore might mislead juries if equated).

70. See *id.*

71. See U.S. Patent No. 8,224,349 B2, at [57] (filed Feb. 25, 2010) (issued Jul. 17, 2012).

72. See *id.* at col. 1 l. 12–14, 30–32.

73. See *id.* at col. 1 l. 34–37.

74. See E-mail from Mark Pfoff, *supra* note 12.

75. See SWGDE, *supra* note 28, at 12.

76. Transcript of Hearing at 53, Colorado v. Pinney, No. 16CR742 (Dist. Ct. Weld Cnty. Dec. 4, 2017) (testimony of Dustin DiPentino, AT&T Radio Frequency Engineer and Technical Communications Manager) [hereinafter Pinney Transcript].

77. See generally AT&T Patent, *supra* note 15.

78. See SWGDE, *supra* note 28, at 20.

79. See Motion in Limine Under Ohio Evid. R. 702(C) to Exclude the AT&T NELOS Rep. at 6, Ohio v. Ramirez, No. CR-201501892 (Ct. C.P. Lucas Cnty. Jan. 29, 2016) [hereinafter Ramirez Motion].

in question, to a tower, and back to the phone.⁸⁰ Because a pulse of light would circle the earth seven and a half times in one second, measuring the speed at the level of about a mile or less requires exactly precise calculations.

AT&T claims to have databases and algorithms that can exactly measure the speed of radio waves, however, the content of these databases and the foundation of these algorithms are mostly unknown.⁸¹ Knowing the distance from the phone to the tower essentially creates an arc of possible locations instead of an entire circle or pie-shaped wedge.⁸² (See Figures 1, 2 & 5). This reduction to a single arc of possible location drastically decreases the potential area a cellphone can be located in.⁸³

Comparing CDR triangulation to NELOS, imagine three overlapping circles of .5 miles each. Suppose the antennas were on the same tower. In that case, triangulation would result in an approximate one and a half square mile area the cellphone could be located in.⁸⁴ (See Figure 1). Now imagine if most of that area was removed and you have instead three intersecting arcs. (See Figure 5). That location could be pinpointed down precisely.

However, NELOS technology actually does not pin-down locations precisely.⁸⁵ (See Figure 5). Depending on the estimated range from the tower, the arc of probable location could be wider or more narrow. AT&T provides an estimated accuracy with all of its NELOS reports that ranges from stating to be accurate within twenty-five meters to being accurate within a thousand meters.⁸⁶

Because NELOS uses databases and algorithms to calculate the speed of radio waves, it is possible to assume that it is an amalgamation of several different forms of information.⁸⁷ One of these forms of information is obviously the exact location of a cell site tower

80. See SWGDE, *supra* note 28, at 12.

81. See Pinney Transcript, *supra* note 76, at 29–30.

82. See SWGDE, *supra* note 28, at 12.

83. See *id.*

84. Area of a circle is equal to Pi multiplied by the radius squared ($1.5707sq\ miles = \pi * .5miles^2$).

85. See DANIEL, *supra* note 8, at 80.

86. See Pinney Transcript, *supra* note 76, at 39.

87. See *id.* at 34–35 (discussing different types of algorithms beyond timing advance and triangulation that help provide NELOS with location coordinates for cellphones).

and the equipment on that tower.⁸⁸ Not only must you know the location, you must also know the maintenance on the tower to determine if the equipment is functioning properly.⁸⁹ Other forms of information that may be necessary to identify if the location is the exact direction in which an antenna is pointed.⁹⁰ In one instance an antenna was found that was cross-wired with another antenna on the same pole and thus was receiving signals from the entire opposite direction than it was supposed to be receiving signals.⁹¹

Another known concern regarding NELOS data is how it is presumed to be more accurate within urban areas and less accurate in rural areas.⁹² Radio waves are known to have more interference in urban areas which may decrease the accuracy in these areas.⁹³ Conversely, in rural areas the signals likely have to travel farther, increasing the possibility of an error in the precision timing calculations.⁹⁴

AT&T's Patent Application No. 12/870,254 from August 27, 2010, states that NELOS uses crowd-sourcing to identify the round trip delay time from users with their GPS on and estimates cellphone locations without their GPS on using the known data.⁹⁵ For example, if you have two cellphones in close proximity where one device has its GPS on, and the other device is inside a building and not able to receive GPS signal, it is possible to estimate the time it takes a signal to reach the non-GPS phone based upon the amount of time it took the signal to reach the GPS enabled phone.

Some problems with this crowd-sourcing model are that the GPS-enabled phones need to be capable of precise measurements necessary to assist in the speed-of-light-calculations. The GPS location itself must be accurate. Even if all of this data is accurate, it does not ensure that the round-trip time between the cellphone in question is accurate since its particular signal may have interference not experienced by the other users in that cell site area.

88. *See id.* at 35 (discussing the need to GPS locate every tower receiving signals).

89. *See* Pinney Transcript, *supra* note 76, at 64.

90. *See* DANIEL, *supra* note 8, at 88.

91. *See id.*

92. *See* Pinney Transcript, *supra* note 76, at 47, 63–64.

93. *See* DANIEL, *supra* note 8, at 65–66.

94. *See* Pinney Transcript, *supra* note 76, at 63–64.

95. *See* AT&T Patent Application, *supra* note 15, at [0009].

B. Unresolved Questions About NELOS & How it Builds on Prior Known Technologies

The major concern with NELOS is that radio waves often are distorted or receive interference.⁹⁶ There are no explanations for how AT&T accounts for these distortions.⁹⁷

NELOS was designed by AT&T as an internal tool to troubleshoot problems within their network and help determine where new cell sites need to be located.⁹⁸ Therefore, it does not need to be entirely accurate to suit the purposes AT&T intended. AT&T is only interested in the “bell-curve” accurate points that fall within the expected locations and anomalies are disregarded.⁹⁹

In actual criminal trials, NELOS has been seen to have wildly varying and impossible results. It has located criminal defendants far out into the ocean.¹⁰⁰ It has also located criminal defendants at one location one second and at a far distant location the next second.¹⁰¹ For example, in the murder trial of Dominic Johnson in Alaska, the NELOS records identified the defendant making impossible leaps in distance.¹⁰² The phone showed locations of thirteen unique locations over the course of sixteen minutes.¹⁰³ During closing arguments, the prosecution admitted that the cellphone records are sometimes inaccurate.¹⁰⁴ These anomalies are “rare” but known to AT&T.¹⁰⁵ The anomalies are likely explained by errors in the algorithms or databases

96. See DANIEL, *supra* note 8, at 65–66.

97. See Pinney Transcript, *supra* note 76, at 36.

98. See Pinney Transcript, *supra* note 76, at 30.

99. See Pinney Transcript, *supra* note 76, at 37.

100. See E-mail from Mark Pfoff, *supra* note 12.

101. See *id.*

102. See Tim Rockey, *New Evidence Causes Uproar in Dominic Johnson Murder Case*, FRONTIERSMAN (Dec. 18, 2018), https://www.frontiersman.com/news/new-evidence-causes-uproar-in-dominic-johnson-murder-case/article_7e38732e-02f6-11e9-9861-87b56dc12437.html (indicating the defendant’s phone traveled to thirteen separate locations in the space of sixteen minutes (9:35–51 p.m.)).

103. See *id.*

104. See Hank Davis, *Closing Arguments Heard in Dominic Johnson Murder Trial*, ALASKA’S NEWS SOURCE (Dec. 26, 2018), <https://www.alaskasnewsresource.com/content/news/Closing-Arguments-Heard-in-Dominic-Johnson-Murder-Trial-503535831.html>.

105. See Pinney Transcript, *supra* note 76, at 37–38.

used to create the round-trip delay time, but they cannot be examined due to the proprietary nature of the technology.

Additionally, as noted above, AT&T indicates that the NELOS technology is based upon databases and algorithms.¹⁰⁶ It is unknown if the crowd-sourcing of round-trip delay time is the only way these databases get information. For example, since weather conditions such as temperature and humidity are known factors in electromagnetic pulse obstruction,¹⁰⁷ it is possible that AT&T's databases and algorithms include local weather estimates. There may be dozens or hundreds of factors kept by the databases and calculated by the algorithms, but this information simply is not released to the public or criminal defendants. Further, since a patent application does not ensure that the technology is in active use, it is not even certain that crowd-sourcing of GPS data is being used at all.

Even AT&T's engineers who use NELOS regularly do not know what the algorithms and databases are based on, or cannot say due to the proprietary nature of the technology. One expert witness, a long-term radio frequency engineer and then current Technical Communication Manager for AT&T, stated he was unfamiliar with how NELOS algorithms work.¹⁰⁸ He was unsure if any outside agency had ever tested the validity of NELOS data or had external validation studies done.¹⁰⁹

NELOS location points are generated only about one-percent of the time a phone is in use.¹¹⁰ It may be a random function or based on another algorithm function that has not been released to the public. The technology does not require the cellphone user to be actively using the phone in order to be located.¹¹¹ The phone just has to be receiving a signal.¹¹² This means the phone could be tracked at virtually all times. There is an omni-present system, but one that only tracks users at random without explanation of why these random events occur.

There is not enough information available to the public to know how NELOS operates or why it creates the data points that it does. The

106. See DANIEL, *supra* note 8, at 85–86.

107. See Jari Luomala & Ismo Hakala, *Effects of Temperature and Humidity on Radio Signal Strength in Outdoor Wireless Sensor Networks*, 5 PROC. FEDERATED CONF. ON COMPUT. SCI. AND INFO. SYS. 1247, 1253 (2015).

108. See Pinney Transcript, *supra* note 76, at 12, 18, 45–46, 63.

109. See *id.* at 49.

110. See *id.* at 45.

111. See *id.* at 45–46.

112. See DANIEL, *supra* note 8, at 81.

only fact that can be established about NELOS is that AT&T filed and received a patent for crowd-sourcing of GPS data in order to determine round-trip timing delays, but outside of AT&T, it is unknown what role this crowd-sourcing plays in the actual location of cellphones using the NELOS technology.

III. HOW OPEN QUESTIONS ABOUT NELOS RESULT IN ITS FAILURE TO MEET *DAUBERT* AND *FRYE* STANDARDS FOR ADMISSIBILITY AS EVIDENCE

One of the major concerns with NELOS technology is that it is being equated as the same or similar to radio frequency technology, a known and accepted scientific principle.¹¹³ The difference is simple, NELOS is like a precision stop-clock not radio frequency waves. NELOS measures the speed of radio waves, which travel at a known rate in a vacuum, in non-vacuum conditions where obstructions are known to slow those waves.¹¹⁴ NELOS, then, is technology that accounts for unknown conditions with various databases and algorithms which are unknown based upon technology and equipment that is unknown.

For a technology method applied in a case to be used as evidence, the method must be admissible under the Federal Rules of Evidence, particularly Rule 702.¹¹⁵ Federal and most state courts use the *Daubert* standard to determine if the Federal Rules of Evidence are satisfied.¹¹⁶ This standard first ascertains whether an expert's scientific testimony is based on scientifically valid reasoning, and second determines if that scientific technique was reliably applied to the facts in the case.¹¹⁷ In other words, Federal Rule of Evidence 702 is not constitutionally satisfied if an expert's testimony falls below this standard, and as such, the scientific testimony will be not be admitted.

Some states continue to use the *Frye* standard to evaluate the qualifications of expert witnesses, while others rely on a mix of standards.¹¹⁸ The *Frye* standard requires that expert testimony based on a scientific technique must be generally accepted as reliable in the relevant scientific community and that technique must be reliably

113. See *People v. Owen*, No. 236N-20, 2021 NYLJ LEXIS 128 at *4–5 (N.Y. Sup. Ct. 2021).

114. See *DANIEL*, *supra* note 8, at 81.

115. See *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 587 (1993).

116. See *Christian v. Gray*, 65 P.3d 591, 594 (Okla. 2003).

117. See *Daubert*, 509 U.S. at 591–92.

118. See *Christian*, 65 P.3d at 594.

applied to the facts in the case before it can be accepted into evidence.¹¹⁹ NELOS technology appears to fall below the standards of either the *Daubert* or *Frye* tests. As such, testimony reliant on NELOS technology should not be admitted into evidence.

A. Applying the *Daubert* Test

In *Daubert v. Merrell Dow Pharmaceuticals Inc.*, the United States Supreme Court expressly indicates that Federal Rule of Evidence 702 allows a judge to exercise a gate-keeper role regarding expert witnesses.¹²⁰ The inquiry of whether a scientific method is permissible under Federal Rule of Evidence 702 is flexible, but the Court cautioned that an expert witness should be given greater scrutiny than a lay witness because scientific evidence can often be misleading.¹²¹ Specifically, *Daubert* requires judges to assess whether the reasoning or methodology underpinning expert testimony is scientifically valid.¹²² Judges must also evaluate whether that reasoning or methodology was properly and reliably applied to the specific facts at issue in the case.¹²³

1. NELOS Does Not Meet the Standard for Being Based on Reasoning and Methodologies that Are Scientifically Valid

NELOS cannot be shown to be based on scientifically valid reasoning.¹²⁴ Scientific knowledge means that the party seeking to admit the evidence must demonstrate that it is the product of scientific methodology.¹²⁵ Scientific methodology then is formulating hypotheses and performing experiments to prove or disprove the hypotheses.¹²⁶ Factors that the court looks at to determine if scientific methodology has been used are (1) whether the technique or theory is generally accepted in the scientific community,¹²⁷ (2) whether the

119. See *State v. Villanueva*, No. 36694-4-III, 2020 Wash. App. LEXIS 3290, *35–36 (Wash. Ct. App. Dec. 17, 2020).

120. See *Daubert*, 509 U.S. at 597.

121. See *id.* at 595.

122. See *id.*; *O’Conner v. Commonwealth Edison Co.*, 13 F.3d 1090, 1106 (7th Cir. 1994).

123. See *Daubert*, 509 U.S. at 592–93.

124. See *Browning v. State*, No. 19A-CR-2522, 2020 Ind. App. Unpub. LEXIS 959, *22–23 (Ind. Ct. App. Aug. 6, 2020).

125. See *Daubert*, 509 U.S. at 593.

126. See *id.*

127. See *id.* at 594.

technique has been through peer review and publication,¹²⁸ (3) whether the technique has been or can be tested,¹²⁹ and (4) whether the technique has a known error rate and maintenance of standards for control.¹³⁰ These are flexible standards,¹³¹ and sometimes a fifth standard is included: (5) whether the research was conducted independent of the particular case at hand.¹³²

Because there are many issues yet to be resolved regarding what NELOS technology is, any party seeking to prove the technology is scientifically valid would be unable to meet the preponderance of evidence burden.¹³³

i. It is Unclear if this Technique is Generally Accepted in the Radio-Network Engineering Community

Taking each factor in turn, the first factor requires the technique to have been generally accepted in the scientific community. Regarding NELOS, the evaluation of this factor hinges on three arguments: whether it is NELOS itself that needs to be accepted or whether only the much broader idea of cellphone triangulation needs to be accepted; what does it mean for a scientific community to have accepted a technology; and what is a “scientific community.”

NELOS is a set of algorithms that calculates distances.¹³⁴ It is not radio waves, radio wave speed, or the triangulation of radio waves. All of those technologies underlying NELOS are generally accepted as based on the scientific method.¹³⁵ Although courts have confused this

128. *See id.* at 593–94.

129. *See id.* at 593.

130. *See Daubert*, 509 U.S. at 594. Sometimes five factors are listed under the *Daubert* test instead of four. The “error rate” and “standards and methods of control” are often listed separately where here they are combined as per the original *Daubert* opinion. *See e.g.*, DEBORAH JONES MERRITT & RIC SIMMONS, *LEARNING EVIDENCE: FROM THE FEDERAL RULES TO THE COURTROOM* 786–87 (5th ed. 2022). *See also Daubert*, 509 U.S. at 594.

131. *See Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 150 (1999).

132. *See Daubert v. Merrell Dow Pharm.*, 43 F.3d 1311, 1317 (9th Cir. 1995).

133. *See Daubert*, 509 U.S. at 593 (holding that matters concerning qualification as an expert witness are to be established by a preponderance of proof); *United States v. Ewell*, 252 F. Supp. 2d 104, 110 (E.D. N.J. 2003) (“The proponent of the expert testimony has the burden of proving its admissibility by a preponderance of the evidence.”)

134. *See DANIEL*, *supra* note 8, at 87.

135. *See Browning v. State*, No. 19A-CR-2522, 2020 Ind. App. Unpub. LEXIS 959, *23–24 (Ind. Ct. App. Aug. 6, 2020).

issue,¹³⁶ NELOS builds upon those technologies in novel ways. However, it is permissible for courts to consider how established scientific technologies support the conclusion that the newer technology is admissible.¹³⁷ Evaluation of the specific, newly created, technology is what is important in a *Daubert* analysis.¹³⁸ Courts need to look at the *new* technology, not just accept that the *underlying* technology was admissible.¹³⁹ Courts that have accepted NELOS as admissible erred because they failed to make this crucial distinction.¹⁴⁰

A scientific community has to accept the novel technology. Literature and testing can help prove that a new scientific theory has gained acceptance.¹⁴¹ But “where no testing [has been] performed, a court cannot examine the reliability or general acceptance of the testing methodology because it does not exist.”¹⁴² Here, the lack of publicly available literature and testing of NELOS weighs against the technology being widely accepted.¹⁴³

The NELOS scientific community is broader than just the telecommunications carriers. The scientific community has to be the relevant community to the technology or technique in question.¹⁴⁴ Widespread acceptance of a technique lends weight that a technique is admissible, whereas a technique that has only minimal support within the community may be “properly . . . viewed with skepticism.”¹⁴⁵ An expert’s assertion that they have used generally accepted scientific methods is not sufficient to establish acceptance within a relevant

136. *See id.* at *24.

137. *See* United States v. Downing, 753 F.2d 1224, 1238 (3d Cir. 1985).

138. *See* Alves v. Mazda Motor of Am., Inc., 448 F. Supp. 2d 285, 298–99 (D. Mass. 2006) (stating that technology accepted in one application shouldn’t be considered acceptable in another application).

139. *See id.* at 298.

140. *See e.g.* People v. Owen, No. 236N-20, 2021 NYLJ LEXIS 128, at *1–6 (N.Y. Sup. Ct. Mar. 1, 2021) (treating PCMD as the same as CSLI); State v. Villanueva, No. 36694-4-III, 2020 Wash. App. LEXIS 3290, at *35–38 (Wash. Ct. App. Dec. 17, 2020) (calling NELOS data CSLI and holding that NELOS is admissible because CLSI is admissible).

141. *See* Hendrix v. Evenflo Co., 255 F.R.D. 568, 599 (N.D. Fla. 2009).

142. Giorgini v. Ford Motor Co., No. 06-0968, 2008 U.S. Dist. LEXIS 25344, at *34 (E.D. Pa. Mar. 28, 2008).

143. *See* Ramirez Motion, *supra* note 79, at 6–8 (indicating that the trial attorney could not find any peer reviewed studies and had to rely only on patent filings).

144. *See* Lauzon v. Senco Prods., 270 F.3d 681, 691 (8th Cir. 2001).

145. *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 594 (1993).

scientific community.¹⁴⁶ “[S]omething doesn’t become ‘scientific knowledge’ just because it’s uttered by a scientist; nor can an expert’s self-serving assertion that his conclusions were ‘derived by the scientific method’ be deemed conclusive. . . .”¹⁴⁷

In *McClain v. Metabolife*, the Eleventh Circuit held that the assertions of an expert Doctor of Pharmacy who was brought in to testify about the toxicity of a particular herbal weight-loss product and who sought to bolster his expert-testimony by stating his claims were based on “broad principles of pharmacology,” could not be relied on to indicate broader acceptance in a scientific community.¹⁴⁸ In other words, the technology cannot be self-proclaimed as widely accepted.

Here, there are three potentially relevant communities: (1) AT&T itself, (2) the telecommunications industry, or (3) the entire field of telecommunications, including researchers and academics. To be admissible, NELOS needs to be accepted by the third community. NELOS technology is proprietary.¹⁴⁹ AT&T and its employees are likely to testify in court, which, as the developer of the technology and the one applying the methodology, is the equivalent of an expert’s assertion of using scientific methodology without any independent corroboration. No one outside of AT&T would generally know what it is or how it works.¹⁵⁰ Therefore, an opinion from an AT&T expert alone that NELOS is based in science is not likely sufficient to establish it is accepted in a relevant scientific community.

Addressing the telecommunication field as the scientific community in general, it is true that Verizon, and T-Mobile also use similar PCMD technology¹⁵¹; however, it is unclear if this adds to the scientific community or not since these companies may be using different algorithms. Since there are no known independent studies brought forward on this technology as of yet, it is a stretch to say it is accepted in a wider community.¹⁵² It seems that any such claims would necessarily be based on some of the more publicly understood underlying features of NELOS and PCMD technologies.

146. See *McClain v. Metabolife Int’l, Inc.*, 401 F.3d 1233, 1244 (11th Cir. 2005).

147. *Daubert v. Merrell Dow Pharms.*, 43 F.3d 1311, 1315–16 (9th Cir. 1995) (applying *Daubert*, 509 U.S. 579 on remand).

148. See *McClain*, 401 F.3d at 1244.

149. See *Browning v. State*, No. 19A-CR-2522, 2020 Ind. App. Unpub. LEXIS 959, at *23 (Ind. Ct. App. Aug. 6, 2020).

150. See *id.*

151. See *Miletic*, *supra* note 16, at 50.

152. See *supra* note 139–40 and accompanying text.

Therefore, neither AT&T itself nor the telecommunications industry can self-validate NELOS. It has to be accepted in a broader field, but due to its proprietary nature, this is impossible. Because the proponent of NELOS technology would have to establish by a preponderance of the evidence that this individual technique, and not pre-existing known technologies, is accepted, they would not be able to meet that burden because the specific technique in question is not fully disclosed to any relevant scientific community.

However, just because the technology may not be accepted in the relevant scientific community does not make the inquiry entirely dispositive. It only means that NELOS technology can be viewed with skepticism until it is more widely accepted.¹⁵³ The other *Daubert* factors still come into consideration.

ii. It is Likely that NELOS has not been through Peer Review or Publication Because of its Proprietary Nature.

Scrutiny of the scientific community is essential to good science because it helps to identify and exclude serious flaws in scientific methodology.¹⁵⁴ Having a method be peer-reviewed weighs heavily in favor that the technique is admissible because of the heightened ability to detect flaws in the technique.¹⁵⁵ However, the absence of peer review or publication in a scholarly journal does not automatically exclude the technology from admissibility. Courts can accept that there might be valid reasons not to publish¹⁵⁶, but courts should consider that failure to publish indicates that a technology is not peer-reviewed.¹⁵⁷

Here, there is no indication that NELOS technology has ever been published in a scientific or scholarly journal. Therefore, it should be considered to not be peer-reviewed, and this factor would weigh against its admissibility.

iii. It is Unclear if NELOS has Ever Been Tested to Accurately

153. See *Daubert v. Merrell Dow. Pharms., Inc.*, 509 U.S. 579, 594 (1993).

154. See *id.* at 593; *Allison v. McGhan Med. Corp.*, 184 F.3d 1300, 1313 (11th Cir. 1999).

155. See *in re Lipitor (Atorvastatin Calcium) Mktg., Sales Pracs. & Prods. Liab. Litig.*, No. 2:14-mn-02502-RMG, 2016 U.S. Dist. LEXIS 30355, at *19 (D. S.C. Feb. 29, 2016).

156. See *Ambrosini v. Labarraque*, 101 F.3d 129, 137 (D.C. Cir. 1996).

157. See *in re Bausch & Lomb Contact Lens Sol. Prods. Liab. Litig.*, No. 772:06-MN-777-DCN, 2009 U.S. Dist. LEXIS 83849, at *36 (D. S.C. Aug. 26, 2009).

Locate a Historic Cellphone Record

The absence of testing is usually a threshold requirement to eliminate unreliable scientific methods.¹⁵⁸ However, if the scientific method is based upon underlying foundational principles that have been tested, the absence of testing is not entirely fatal.¹⁵⁹ Testing in effect serves as a form of “meaningful cross-examination”¹⁶⁰ The scientific technique must have been or must be able to be tested in order to be reliable.¹⁶¹ The testing must be appropriate to how the method is applied, and must analytically prove the expert’s hypothesis.¹⁶²

Even an AT&T radio frequency engineer does not know if NELOS algorithms had ever been tested by outside entities or if the algorithms ever had any validations studies done on them.¹⁶³ Certainly, it is logical to assume that AT&T has tested its equipment, but the prosecution having the burden of proof cannot establish these tests were peer-reviewed.

When a digital forensics consultant attempted to test NELOS to determine if it would accurately locate a cellphone in a known location, NELOS was not able to once locate the phone within the actual vicinity of where it was located and often located the phone in a direction that would be impossible based simply on the angle of the antenna.¹⁶⁴

The testing factor weighs heavily against NELOS being admissible as evidence. Clearly, tests are being done, but it is unclear precisely what hypothesis NELOS is being tested for, and since independent tests can only be ad-hoc, it would be difficult for a proponent of NELOS to be able to prove by a preponderance of the evidence that NELOS had in fact been tested as it relates to locating a single cellphone.

158. See *Brumley v. Pfizer, Inc.*, 200 F.R.D. 596, 602 (S.D. Tex. 2001).

159. See *in re Actos Prods. Liab. Litig.*, No. 12-cv-00064, 2013 U.S. Dist. LEXIS 179235, at *41–42 (W.D. La. Dec. 19, 2013).

160. *City of Pomona v. SQM N. Am. Corp.*, 750 F.3d 1036, 1046 (9th Cir. 2014).

161. See *id.* (citing *Cooper v. Brown*, 510 F.3d 870, 880–81 (9th Cir. 2007)).

162. See *Presley v. Lakewood Eng’g & Mfg. Co.*, 553 F.3d 638, 646 (8th Cir. 2009).

163. See *supra* text accompanying notes 88–89.

164. See DANIEL, *supra* note 8, at 85.

iv. Although AT&T Provides an Estimate of the Accuracy of the NELOS Data, the Actual Accuracy Rate is Unknown and the Standards of Control for the Technology are also Unknown

Determination of an error rate requires evaluating other potential variables that may affect the technology.¹⁶⁵ In the instance of radio wave technology, there are many known obstructions that will affect the speed of the transmissions. Even similar phones on the same network often receive very different signal strengths.¹⁶⁶ This means that phones might connect to towers they are not expected to connect with.¹⁶⁷ There also is the issue of multi-pathing which is where cellphones can reflect off of objects like buildings and signs.¹⁶⁸ If a cellphone is inside a building, then the building materials might block a signal, forcing it to go in a different direction, or the height might cause it to reach above an expected tower.¹⁶⁹ Lastly, even unusual terrain features such as valleys or mountains or weather conditions can slow the cellphone's radio waves in their travel to a nearby tower.¹⁷⁰ Anyone who has ever faced a "trouble spot" for connection can sympathize with these obstacles to a clear connection, but there is no explanation for how NELOS technology unravels these variances of daily living.

NELOS technology does come with an estimate of the error rates, but a very striking feature is that NELOS technology is accompanied by a warning that the data results cannot be relied on for investigations.¹⁷¹

The results provided are AT&T's best estimate of the location of the target number. Please exercise caution in using these records for investigative purposes as location data is sourced from various databases which may cause location results to be less than exact.¹⁷²

165. See *United States v. Diaz*, No. CR 05-0167 WHA, 2006 U.S. Dist. LEXIS 91068, at *20 (N.D. Cal. Dec. 6, 2006).

166. See DANIEL, *supra* note 8, at 64.

167. See *id.*

168. See *id.* at 65.

169. See *id.*

170. See *id.* at 66.

171. See DANIEL, *supra* note 8, at 87.

172. *Id.* at 85.

This warning directly conflicts with the idea that the standards controlling the technique's operation must exist and be maintained.¹⁷³ Because AT&T itself admits that the NELOS data is based off databases that may not be exact, it should not be considered as having a known error rate or being applied using known and reliable standards of control.

v. NELOS is Generally Collected Independently of any Particular Case

Perhaps the strongest factor weighing in favor of the admissibility of NELOS data is that it is collected independent of any investigation or litigation process. It is a very significant factor to have an expert testify about a matter growing out of their independent application of the science without those opinions being created for the purposes of evidence in a case.¹⁷⁴

Having applied NELOS for its own purposes, AT&T is not acting at the behest of anyone other than itself. Because AT&T has an independent business purpose of wanting its technology to be based on science, it stands to reason that it would not propose to test its network with technology that does not work, is not reliable, or is not based on the scientific method.

A counter argument here is that AT&T is using this technology to test its network independent of its application to cellphone tracking. Certainly, it is possible that AT&T's network testing capability is grounded in strong fundamental science, and it does what it is supposed to do; however, that does not necessarily support the theory that the technology completes a different task equally as well. There may be structural flaws within the databases that allow it to work for network testing and not location identification.

2. NELOS Does Not Meet Daubert Standards Because its Underlying Reasoning and Methodology Cannot be Shown to Have Been Properly and Reliably Applied to the Facts of a Case

Even if a trial court found that NELOS met the first prong of the *Daubert* test, NELOS would still fail the second prong of *Daubert*. A trial court must examine if the scientific technique in question has been

173. See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 594 (1993).

174. See *Harrison v. Howmedica Osteonics Corp.*, No. CIV 06-0745 PHX RCB, 2008 U.S. Dist. LEXIS 26197, at *49 (D. Ariz. Mar. 27, 2008).

properly applied to the facts of a given case.¹⁷⁵ The testimony must be able to assist or be helpful to the trier of fact.¹⁷⁶ Some factors of measuring reliability are: (1) the nature of the issue, (2) the expert's particular expertise,¹⁷⁷ and (3) the subject of the expert's testimony.¹⁷⁸ There must be a "fit" between the scientific method and the facts in a case.¹⁷⁹ It is up to the proponent of the evidence to establish that the scientific methodology has been reliability applied to the facts of a case.¹⁸⁰ "[C]ourts must still look long and hard at the expert's principles and methods. . . ."¹⁸¹ Fit is not always obvious, and the fit for one valid scientific purpose doesn't carryover to other unrelated purposes.¹⁸²

In *Alves v. Mazda Motor of America*, the Massachusetts District Court excluded airbag deployment evidence that was "reliable in certain circumstances" but which the plaintiff had not established was scientifically reliable at the speeds in which the actual crash at issue occurred.¹⁸³

The NELOS technology developed by AT&T was intended to measure the reliability and capacity of AT&T's cellular network.¹⁸⁴ It was not designed to determine the exact location of a cellphone.¹⁸⁵ Because the technique is being applied in a manner that it was not intended for, it likely does not meet the reliably applied standard even

175. See *Hollander v. Sandoz Pharms. Corp.*, 289 F.3d 1193, 1204 (10th Cir. 2002); *United States v. Finley*, 301 F.3d 1000, 1007–08 (9th Cir. 2002).

176. See FED. R. EVID. 702(a).

177. Of particular concern is the fact that the current practice is to have law enforcement officers without specific knowledge of PCMD technology testify. For example, in *State v. Dominic Johnson*, an Alaska State Trooper testified that NELOS was admissible even though the trooper had no more access to AT&T's proprietary technology than any other member of the public. See *State of Alaska v. Johnson*, No. 3PA-16-02603CR (D. Alaska Aug. 3, 2018). See also *Browning v. State*, No. 19A-CR-2522, 2020 Ind. App. Unpub. LEXIS 959, at *15 (Ind. Ct. App. Aug. 6, 2020) (FBI Special Agent's testimony about NELOS and his understanding of how the technology worked even though he was unsure which technology NELOS relied on).

178. See *Murray v. S. Route Mar. SA*, 870 F.3d 915, 922 (9th Cir. 2017) (quoting *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 150 (1999)).

179. See *Daubert v. Merrell Dow Pharms. Inc.*, 509 U.S. 579, 591 (1993).

180. See *Alves v. Mazda Motor of Am., Inc.*, 448 F. Supp. 2d 285, 298 (D. Mass. 2006).

181. *United States v. Frazier*, 387 F.3d 1244, 1297 (11th Cir. 2004).

182. See *id.*

183. See *Alves*, 448 F. Supp. at 299.

184. See DANIEL, *supra* note 8, at 80.

185. See Miletic, *supra* note 16, at 50.

if it were to meet the first-prong of the *Daubert* test. As in *Alves* where airbag testing was an accepted scientific method but the application of that method to the rate of speed was not reliably applied to the facts, similarly here the acceptance of radio wave testing does not mean that the NELOS algorithms and databases are reliably applied to the facts of a given case.

However, even if the technology was proven to be scientifically valid for locating a cellphone, the proponent of the NELOS evidence would still have establish by a preponderance of the evidence that the collection techniques for the NELOS data was reliable.¹⁸⁶ Assuming that NELOS involves multiple user devices that have moved through a given area at a historical time, this may be impossible. For example, if NELOS relies on crowd-sourcing GPS data as one patent application suggested, it would be nearly impossible for the proponent of the evidence to track down every person's cellphone in that location at that given time. Further, it would be necessary for the proponent of the evidence to establish that the GPS was properly functioning on the third-party phone and therefore that the data the algorithms are based on was accurate.¹⁸⁷

Added to this impossibility is the issue of cell antennas not being pointed in the exactly right direction or having shifted after installation. Small and likely accidental adjustments to the angle of an antenna could give wildly differing results in location.¹⁸⁸ These adjustments do not even have to be permanent, it is possible that strong winds would affect the towers.¹⁸⁹

Lastly, consider the problem of bad weather or a distorted signal. It seems infeasible that the technology can accurately establish that the weather at an exact time and location was not slightly different than the weather in the general vicinity. It is also highly infeasible to establish that this particular cellphone signal did not reflect off a nearby building or pass through trees or foliage causing a distortion to the signal.

There is of course the option that AT&T could release the fundamental data that their algorithms are relying on, and the proponent could then establish what the known error rates were in

186. See discussion *supra* Part III regarding *Daubert* and *Frye* standards second-prong.

187. See discussion *supra* note 97 and accompanying text.

188. See DANIEL, *supra* note 8, at 88.

189. See DANIEL, *supra* note 8, at 8 (showing how cell towers can be affixed to other buildings) (inference is that cell tower antennas can be affected by weather).

those algorithms through additional scientific testing. A similar question regarding proprietary DNA statistical algorithms came before courts in New York in 2016.¹⁹⁰ A proprietary technology called “STRmix” used algorithms to statistically enhance small amounts of DNA.¹⁹¹ The defendants sought release of the proprietary algorithms and challenged the admissibility of the evidence.¹⁹² However, in the lower court case, the court found that, unlike in the NELOS technology, the New York State Commission on Forensic Science unanimously voted to approve the STRmix technology creating more general acceptance in the community.¹⁹³ And in a Sixth Circuit case, the court relied on the idea that STRmix could be independently tested repeatedly by taking a known DNA sample and comparing it to the STRmix results.¹⁹⁴ With NELOS though, actual tests performed using a known location of a cellphone compared to the NELOS records show totally inaccurate results without once ever locating the phone in the proper location.¹⁹⁵

Unless the proponent of the NELOS data can establish by a preponderance of the evidence that the technology is reliable, testable, and consistent, then NELOS cannot be considered reliably applied to the facts in any given case.

B. Applying the Frye Test

The *Frye* standard of admissibility of an expert witnesses’ scientific or specialized testimony requires that the method by which evidence was obtained must be “sufficiently established to have gained general acceptance in the particular field in which it belongs.”¹⁹⁶ And, as with *Daubert*, it must be reliably applied to the facts in a case. Although the *Frye* standard was replaced by the *Daubert* standard in federal courts, some states still use *Frye*.¹⁹⁷ Since these two prongs were discussed in the *Daubert* analysis, they will not be repeated here. However, it is useful to make an analogy between the original *Frye* case and the decision of the Washington State Court

190. See *People v. Bullard-Daniel*, 42 N.Y.S.3d 714, 715 (Niagara Cnty. Ct. N.Y. 2016); *United States v. Gissantaner*, 990 F.3d 457, 460 (6th Cir. 2021).

191. See *Bullard-Daniel*, 42 N.Y.S.3d at 715; *Gissantaner*, 990 F.3d at 460.

192. See *Bullard-Daniel*, 42 N.Y.S.3d at 724; *Gissantaner*, 990 F.3d at 470.

193. See *Bullard-Daniel*, 42 N.Y.S.3d at 722.

194. See *Gissantaner*, 990 F.3d at 464.

195. See DANIEL, *supra* note 8, at 84–85.

196. See *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923), *overruled* by *Daubert v. Merrell Dow Pharm.*, 509 U.S. 579 (1993).

197. See *Christian v. Gray*, 65 P.3d 591, 595–97 (Okla. 2003).

of Appeals, Division III regarding NELOS to illustrate why NELOS should not be admitted in states that use the *Frye* standard.¹⁹⁸

In *Frye*, the D.C. Circuit Court of Appeals was evaluating if polygraph testing was based on scientific principles.¹⁹⁹ Although the court recognized that blood pressure testing was based in science, the court concluded that making assumptions that blood-pressure would be elevated if a person was being deceptive was not based on a sufficiently recognized scientific principle.²⁰⁰

Whereas in *Frye*, the court was able to distinguish that the underlying scientific method was reliable, but the deductive hypothesis based on that method was not, the Washington State court did not draw such a line between the old CSLI methods and the deduction that new CSLI methods could result in more accurate location data.²⁰¹ In that case, the court reasoned that because CSLI was admissible, it was presumed that NELOS was also admissible.²⁰² It seems that this distinction and recognition of the old technology compared to the newly claimed technology is necessitated by *Frye* and missing in many court decisions.²⁰³

CONCLUSION

NELOS technology is proprietary technology that serves as a case study for a broader technology used by the telecommunications industry to locate cellphones. *Daubert* requires a two-prong test. The first prong is that the technological method be reviewed for valid scientific reasoning using a several-factor test. The proprietary technology cannot meet most of the first-prong factors because proponents of a technology self-claiming that it is generally accepted does not rise to the level of the preponderance of the evidence that the technique is scientifically valid. This test is similar to the *Frye* test, in which NELOS technology also fails for the same reason. Further, under *Daubert*, it is unclear if this technology has been tested or peer-reviewed. And the error rate of the technology seems to be calibrated

198. See generally *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923); *State v. Villanueva*, No. 36694-4-III, 2020 Wash. App. LEXIS 3290, at *15 (Wash. Ct. App. Dec. 17, 2020) *review denied sub nom.* *State v. Mendez Villanueva*, No. 99439-1, 2021 Wash. LEXIS 233 (Wash. Sup. Ct. 2021)).

199. See *Frye*, 293 F. at 1013–14.

200. See *id.* at 1014.

201. See *Villanueva*, 2020 Wash. App. LEXIS 3290 at *35–36.

202. See *id.* at *36.

203. See *supra* notes 138 and 139 and accompanying text.

on a different underlying use of the technology than the location application that is being submitted as evidence.

The technology fails to be admissible for an additional reason as well. The technology fails to meet the second prong of *Daubert* because it cannot be proven to be reliably applied to the facts of a case. Given the secret and historical-facing use of the technology, it is impossible to prove that the technology has been accurately applied to any facts. Because the burden of proof rests on the proponent of the evidence, and the proponent cannot establish that it is a reliable technology that has been reliably applied, NELOS technology should not be admitted as evidence in a court of law.

APPENDIX

Figure 1

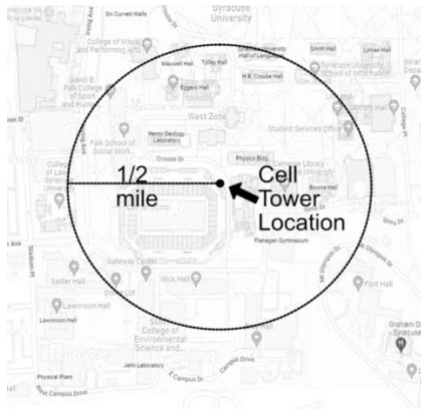


Figure 2

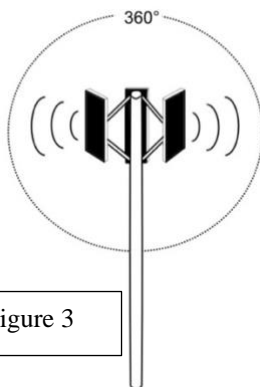
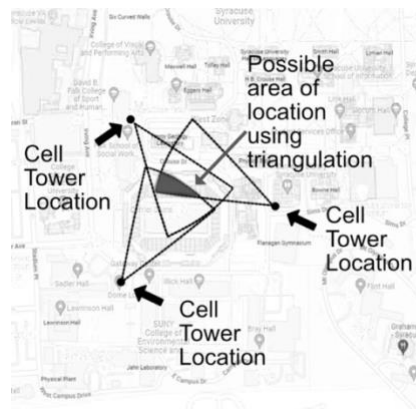


Figure 3

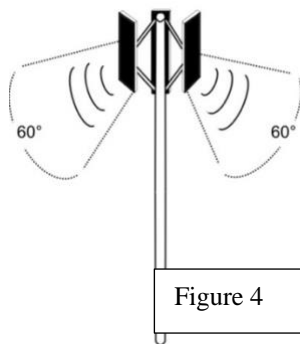


Figure 4

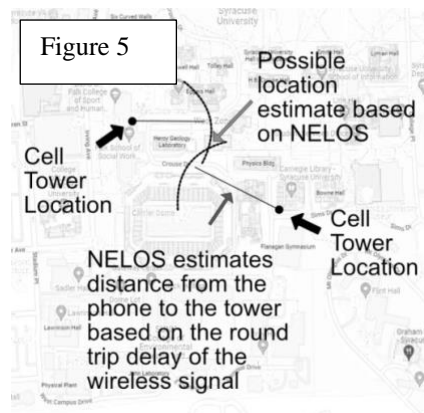


Figure 5