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Geophysical Trespass, Privacy, and Drones in Oil and Gas Exploration

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GEOPHYSICAL TRESPASS, PRIVACY, AND DRONES IN OIL AND GAS EXPLORATION

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I. INTRODUCTION

AS TECHNOLOGY CONTINUES to expand the potential uses for unmanned aerial systems (UAS) in the commercial sector, drones are becoming an increasingly common sight in the United States. The Federal Aviation Administration (FAA) predicts that new technology, coupled with relaxed regulations promulgated under the Small Unmanned Aircraft Systems Rule,[1] will accelerate growth in the coming years, and that by 2022, there will be over 450,000 small UAS in use for commercial purposes.[2]

One industry that has seen especially high growth in the use of UAS is the oil and gas industry.[3] Currently, drones are most frequently deployed to inspect infrastructure like pipelines, drilling rigs, and refineries.[4] However, they are beginning to take on roles in exploration operations, and as the technology continues to improve, the potential uses in this phase are seemingly limitless.[5]

While this potential is certainly exciting, both property owners and exploration companies alike should be cognizant of the legal implications of the expanding usage of UAS in the oil and gas industry. Drone technology has the chance to revolutionize how exploration operations are conducted moving forward. At the same time, these new capabilities strain the application of common law property and privacy principles developed at a time when UAS technology could not even be fathomed.

As a result, it appears that currently the most viable way to take advantage of UAS—to efficiently develop the country's energy resources—and also adequately protect mineral and surface interest holders is to specifically address drones when

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[1] Operation and Certification of Small Unmanned Aircraft Systems (Small UAS Rule), 81 Fed. Reg. 42,064 (June 28, 2016).

[2] U.S. DEP'T OF TRANSP., TC 18-0004, FAA AEROSPACE FORECAST: FISCAL YEARS 2018–2038, at 42 (2018).

[3] Thaddeus R. Lightfoot, *Bring on the Drones: Legal and Regulatory Issues in Using Unmanned Aircraft Systems*, 32 NAT. RES. & ENV'T 41, 43 (2018).

[4] *Cf.* Rodney Lopez & Jack Caldwell, *Drones Take on Roles in Land Seismic Data Acquisition Operations*, HART ENERGY (Jan. 11, 2017), https://www.epmag.com/drones-take-roles-land-seismic-data-acquisition-operations-1456391 [https://perma.cc/BN2M-7XP9].

[5] *Cf. id.*

negotiating and drafting agreements. However, if for any reason contracting proves ineffective in this pursuit, the FAA or the states must intervene to properly advance property and privacy law into the age of drones.

In Part II, this Comment will examine how most U.S. airspace came to be under the control of the federal government and what regulations and legislation have passed in some of the major oil and gas production states. Part III will briefly introduce common geophysical surveying techniques and discuss the current and potential future applications of UAS in the exploration phase. Part IV of this Comment will then discuss property owners' rights in the subsurface and surface under existing oil and gas law precedent and examine the ways that property owners and exploration companies can use common contractual agreements to address some of the issues drones present. Finally, Part V will examine the application of the traditional common law privacy torts of intrusion upon seclusion and of publication of private life as well as analogous offenses under a Texas statute that specifically applies to drones.

II. DEVELOPMENT AND CURRENT STATE OF THE LAW REGULATING DRONES

A. History of the Regulation of U.S. Airspace

Despite the persistence of the English common law *ad coelum* doctrine[6] in subsurface rights, modern reality has significantly eroded its upward reach.[7] Due to the impracticality of alternatives, such as obtaining airspace easements from individual landowners or condemning the airspace above individual tracts, Congress passed the 1926 Air Commerce Act[8] to effect free air travel.[9] The Air Commerce Act vested complete and exclusive national sovereignty over the air space, creating a "public right of freedom of interstate and foreign air navigation" through navigable airspace.[10] Navigable airspace is the "airspace above

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[6] The doctrine in its original form stood for the rule that a landowner's possessory right extended from the soil downward to the center of the earth and upward to the heavens. Robert A. Hazel, *Privacy and Trade Secret Law Applied to Drones: An Economic Analysis*, 19 Colum. Sci. & Tech. L. Rev. 340, 345 (2018).

[7] *See* Owen L. Anderson, *Lord Coke, the Restatement, and Modern Subsurface Trespass Law*, 6 Tex. J. Oil Gas & Energy L. 203, 212 (2011).

[8] Air Commerce Act of 1926, Pub. L. No. 69-254, 44 Stat. 568.

[9] Hazel, *supra* note 6, at 345–46.

[10] Air Commerce Act of 1926 § 10.

the minimum safe altitudes of flight" prescribed by the appropriate regulatory agency.[11]

These principles were further developed by the Supreme Court in *United States v. Causby*.[12] The Court stated as a general principle that "[t]he air is a public highway," and flights operating in that highway are not trespassing.[13] It also upheld the validity of the minimum safe altitudes then prescribed by the Civil Aeronautics Authority,[14] but it carved out an important exception that, in all cases, the landowner "must have exclusive control of the *immediate reaches* of the enveloping atmosphere" to use his land.[15] Thus, presumably property owners retain the right to exclude others from entering this space.[16]

B. Federal Regulation of Drones

The current minimum safe altitudes for UAS prescribed by FAA regulations are 500 feet above uncongested areas and 1,000 feet above the highest obstacle in congested areas.[17] Although the FAA has the authority to regulate aircraft at any altitude, it has historically left control of the airspace up to 500 feet to the states.[18] However, the FAA is now becoming more involved in this space, largely because it is the airspace most drones operate in.[19]

Because drones meet the statutory definition of "aircraft,"[20] all drones operating in the National Airspace System (NAS) fall under the regulatory authority of the FAA.[21] Before 2012, the FAA treated drones used for civil purposes like any other aircraft.[22] In this early era of regulation, all FAA rules applied to

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[11] *Id.*

[12] 328 U.S. 256, 260 (1946).

[13] *Id.* at 261.

[14] *Id.* at 263–64. The Civil Aeronautics Authority was the predecessor agency to the FAA.

[15] *Id.* at 264 (emphasis added).

[16] *See* Hillary B. Farber, *Keep Out! The Efficacy of Trespass, Nuisance and Privacy Torts as Applied to Drones*, 33 Ga. St. U. L. Rev. 359, 406 (2017).

[17] 14 C.F.R. § 91.119(b)–(c) (2010).

[18] Farber, *supra* note 16, at 391.

[19] *See id.*

[20] Aircraft means "any contrivance invented, used, or designed to navigate, or fly in, the air." 49 U.S.C. § 40102(a)(6) (2012).

[21] Lightfoot, *supra* note 3, at 41. The National Airspace System (NAS) is the FAA term synonymous with the "public highway" through the air described in *Causby*. *Id.*

[22] *Id.* (citing 72 Fed. Reg. 6689, 6690 (Feb. 13, 2007)).

drones operating in the NAS, irrespective of their size.[23] However, only drones used for commercial purposes were subject to mandatory rule compliance.[24] Compliance by drones used for recreational purposes was merely voluntary.[25]

In 2012, Congress passed legislation seeking to provide clarity on drone use and accelerate the integration of civil UAS into the NAS.[26] Section 332 of the FAA Modernization and Reform Act of 2012 (2012 Act) commanded the FAA to "develop a comprehensive plan to safely accelerate the integration of civil unmanned aircraft systems into the national airspace system" within 270 days of the date of the 2012 Act's enactment.[27] That section also required the FAA to promulgate final regulations allowing for the civil operation of small commercial UAS systems[28] that did not meet the requirements for expedited certification under section 333.[29]

Pursuant to section 333, the FAA established a process to allow for commercial use by applying for a Certificate of Authorization (COA), exempting the need for an airworthiness certificate.[30] However, the application process is exceedingly complex, and applicants waited an average of four to six months for a COA to be granted.[31] Further, applicants had to show that the intended use was in the public interest and that a drone operating under a COA would be flown by a person holding the same credentials the FAA requires for pilots of airplanes and other manned aircraft.[32]

Although the section 333 requirements remain in force to operate larger commercial drones, the FAA issued new regulations in 2016 that substantially reduced the requirements for small

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[23] *Id.*

[24] *Id.*

[25] *Id.*

[26] FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, §§ 331–36, 126 Stat. 11, 72–78 (codified at 49 U.S.C. § 40101 (2012)).

[27] *Id.* § 332.

[28] Section 336 of the 2012 Act exempted drones used for recreational uses from FAA regulation, provided they weighed less than fifty-five pounds, were flown within a visual line of sight of the operator, and were not flown within five miles of an airport without notice, among other requirements. *See id.* § 336.

[29] *Id.* § 332(b).

[30] *See* Lightfoot, *supra* note 3, at 42 (citing FAA Modernization and Reform Act § 333); *see also* Farber, *supra* note 16, at 360.

[31] *See* Farber, *supra* note 16, at 360–61.

[32] Lightfoot, *supra* note 3, at 42.

commercial UAS.[33] The regulations, commonly collectively referred to as the Small UAS Rule, apply to "[s]mall unmanned aircraft system[s] (small UAS)," which are unmanned systems with a gross weight less than fifty-five pounds.[34]

Under the Small UAS Rule, commercial use of small UAS is permissible by any person who has a "remote pilot certificate with a small UAS rating" or by anyone "under the direct supervision of a remote pilot in command."[35] Thus, uncertified persons may still pilot small UAS from a command center so long as a certified person "has the ability to immediately take direct control of the flight."[36] To become certified, a person must, among other requirements, be at least sixteen years old and pass an aeronautical knowledge test or already hold a Part 61 pilot certificate.[37] Certification is good for up to twenty-four months, at which point a recurring knowledge test must be passed in order to maintain it.[38]

The Small UAS Rule also includes a number of operational limitations and requirements.[39] One of the most notable is the requirement that a certified pilot, or both the certified pilot in command and the person actually piloting the drone, must be able to see the drone throughout the entire flight without the aid of "any device other than corrective lenses."[40] An alternative allows small UAS to be operated from a remote location, provided there is a visual observer on site who can fulfill the responsibilities otherwise required of the pilot, and the visual observer and pilot "maintain effective communication" throughout the flight.[41]

Further, small UAS are not permitted to operate more than 400 feet above the ground, or if operating within 400 feet of a

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[33] *See generally* Operation and Certification of Small Unmanned Aircraft Systems (Small UAS Rule), 81 Fed. Reg. 42,064 (June 28, 2016).

[34] 14 C.F.R. § 107.3 (2016). Everything attached to the drone and any other "associated elements," including communication links and control components, counts toward the fifty-five-pound limit. *Id.*

[35] *Id.* § 107.12.

[36] *Id.*

[37] *Id.* § 107.61. The certification requirements under Part 61 are the more rigorous certification requirements for pilots of manned aircraft and for pilots of commercial UAS operating under a section 333 exemption. *See generally* 14 C.F.R. pt. 61.

[38] *See* 14 C.F.R. § 107.65.

[39] *See* Lightfoot, *supra* note 3, at 42–43.

[40] 14 C.F.R. § 107.31(a).

[41] *See id.* §§ 107.31(b), 107.33.

structure, no more than 400 feet above that structure.[42] Minimum distances from clouds must also be maintained at all times.[43] Other limitations include a prohibition on nighttime flights[44] and special rules involving flights near airports.[45]

Under 14 C.F.R. § 107.200, the FAA may issue a certificate of waiver authorizing deviations from some of the rules.[46] All the restrictions described above are among those that can be waived through this process.[47] Significantly, however, the fifty-five pound weight limit cannot be waived.[48] To be granted a certificate of waiver, an application must completely describe the proposed flight operation and provide sufficient justification to establish that the operation can still be performed safely in spite of the requested deviation.[49] Historically, applications that are highly customized and include specific details about the operation, such as the date and location, tend to have the highest rate of success in receiving approval.[50]

C. State Laws Addressing Drones

The FAA has historically left control of the airspace below 500 feet to the states. Although the FAA is becoming increasingly involved in this space, since 2013 a substantial number of bills addressing UAS have been considered and passed by states.[51] As of September 2018, forty-one states had enacted laws targeting drones and another three had adopted resolutions.[52] Among this group are a number of major oil and gas states—including California, Louisiana, Oklahoma, and Texas.[53]

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[42] *Id.* § 107.51.

[43] *Id.* Small UAS must be no less than 500 feet below a cloud or 2,000 feet horizontally from one. *Id.*

[44] *Id.* § 107.29.

[45] *See id.* § 107.41; *see also* Lightfoot, *supra* note 3, at 43.

[46] 14 C.F.R. § 107.200.

[47] *See id.* § 107.205.

[48] *See id.*; *see also* Lightfoot, *supra* note 3, at 43.

[49] 14 C.F.R. § 107.200.

[50] Lightfoot, *supra* note 3, at 43.

[51] *Current Unmanned Aircraft State Law Landscape*, Nat'l Conf. St. Legislatures (Sept. 10, 2018), http://www.ncsl.org/research/transportation/current-unmanned-aircraft-state-law-landscape.aspx#1 [https://perma.cc/8ECU-8L75].

[52] *Id.*

[53] *Id.*; Amanda Essex, Nat'l Conference of State Legislatures, Taking Off: State Unmanned Aircraft Systems Policies 14, 19, 26 (2016). North Dakota has also passed legislation, but it does not touch on any of the issues discussed herein.

In response to the use of UAS by paparazzi,[54] California updated its privacy laws to include wording that makes entering the airspace above the land of another without permission an actionable violation for invasion of privacy.[55] As will be discussed more in-depth in the privacy section of this Comment, the California statute has limited utility when applied to drones used for oil and gas exploration because intent must be shown to establish a violation.[56]

Louisiana updated its general trespass law to specifically address drones, criminalizing the operation of UAS over the property of another with the intent to conduct surveillance of the property or an individual lawfully thereon.[57] However, it is doubtful the change has any meaningful effect because UAS being operated in compliance with federal law and FAA regulations are specifically excepted from liability.[58] Updates have also been made to the criminal privacy offenses of video voyeurism,[59] voyeurism,[60] and peeping tom.[61] Under each, a drone must be used for the purpose of committing the relevant offense to constitute a violation.[62]

Oklahoma law prohibits intentionally or knowingly operating a drone within 400 feet of a "critical infrastructure facility," and provides for civil liability for a violation.[63] Although the definition of critical infrastructure facility encompasses a wider range of oil-and-gas-related structures potentially implicating exploration activities,[64] the law is clearly targeted at recreational drone use.[65] The law does not apply to an operator of a drone being used for commercial activities if the operator is authorized to operate in that airspace by the FAA.[66] Thus, like Louisiana,

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[54] *State Unmanned Aircraft Systems (UAS) — 2015 Legislation*, NAT'L CONF. ST. LEGISLATURES (Sept. 30, 2016), http://www.ncsl.org/research/transportation/state-unmanned-aircraft-systems-uas-2015-legislation.aspx [https://perma.cc/V4S6-NNKW].

[55] CAL. CIV. CODE § 1708.8(a) (West 2019).

[56] *See id.* § 1708.8(f) (requiring actual knowledge to commit a violation).

[57] LA. STAT. ANN. § 14:63 (2016).

[58] *See id.*

[59] *Id.* § 14:283.

[60] *Id.* § 14:283.1.

[61] *Id.* § 14:284.

[62] *Id.* §§ 14:283, 283.1, 284.

[63] OKLA. STAT. ANN. tit. 3, § 322 (West Supp. 2018).

[64] Examples include: natural gas compressors, liquefied natural gas terminals or storage stations, and above-ground portions of oil or gas pipelines. *Id.*

[65] *Cf. id.*

[66] *Id.* § 322(D).

Oklahoma state law has little applicability to drones used in connection with exploration activities.

In Texas, it is a criminal offense to use a drone to capture an "image" of an individual or privately owned real property if the operator does not destroy the image as soon as he becomes aware it was captured or if the operator discloses, displays, or distributes the image to any third party.[67] Civil actions are also available to enjoin this activity, and actual damages may be recovered if disclosure, display, or distribution occurred with malice.[68] Critically, an "image" is defined as "any capturing of *sound waves*, thermal, infrared, ultraviolet, visible light, or *other electromagnetic waves*, odor, or other conditions existing on or about real property . . . or an individual located on that property."[69] Further, the law makes no general exception for commercial drones operating in compliance with FAA regulations.[70] While this law may afford meaningful protection to property owners, it could result in significant consequences for unaware or careless operators.

III. INTRODUCTION TO OIL AND GAS EXPLORATION METHODOLOGY AND THE USE OF DRONES

A. Seismic Surveying

Oil and gas companies have been utilizing seismic surveying for the better part of the last century.[71] Seismic imaging utilizes sound waves to map the subsurface based on the variance in speed with which the waves move through formations of different densities.[72] As waves bounce back off of underground geologic formations, they are recorded by devices on the surface.[73] Measuring the time it takes for a wave to reach the surface recording device from the shot point indicates the density of the underlying formation.[74] Waves moving through looser formations such as sands or shale return to the surface more slowly,

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[67] *See* Tex. Gov't Code Ann. §§ 423.003–423.004.

[68] *Id.* § 423.006.

[69] *Id.* § 423.001 (emphasis added).

[70] *Cf. id.* § 423.002.

[71] *See* P.R. Reddy, *Historical Development of Seismic Imaging Technique–An Overview*, 16 J. Indian Geophysical Union 71, 75 (2012).

[72] O. Scott Petty, *Oil Exploration*, Tex. St. Hist. Ass'n, https://tshaonline.org/handbook/online/articles/doo15 [https://perma.cc/3TXS-QACB] (last updated Dec. 16, 2010).

[73] *Id.*

[74] *See id.*

whereas waves traveling through dense, crystalline formations such as limestone, rock salt, and others move at a very high rate of speed.[75] Experts then use the images derived from this data to predict where hydrocarbons may be trapped and to identify potential drilling prospects.[76]

Advances in technology have drastically increased the ability to analyze the seismic data collected.[77] Until the 1980s, seismic surveys were conducted by placing receivers along a straight line, producing a two-dimensional (2-D) image when the data was processed by a computer.[78] Though this method, known as 2-D seismic, was a substantial upgrade over wildcatting, it pales in comparison to three-dimensional (3-D) seismic in identifying productive formations.[79] With 3-D seismic, the energy source points, which generate the waves, and the recording devices are each placed in parallel lines that are approximately perpendicular to each other, creating a grid.[80] When processed by a computer, the data collected using this method results in a three-dimensional rather than two-dimensional image. This added level of detail has substantially improved the success rate in identifying productive formations.[81]

B. Gravity and Magnetic Surveying

Although seismic surveying is the dominant and most reliable method for oil and gas exploration, both gravity and magnetic surveying are also widely utilized in conjunction with seismic surveying or on their own.[82] The gravitational force exerted by

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[75] *Id.*

[76] *See* John McFarland, *How Do Seismic Surveys Work?*, Oil & Gas Law. Blog (Apr. 15, 2009), https://www.oilandgaslawyerblog.com/how-do-seismic-surveys-work/ [https://perma.cc/738Y-EAML].

[77] *See* Owen L. Anderson, *Geophysical "Trespass" Revisited*, 5 Tex. Wesleyan L. Rev. 137, 137–38 (1999).

[78] Davis Mosmeyer, Comment, *Ubi Jus Ibi Remedium: The Gap in Texas Courts' Protection of Mineral Owners Against Unpermitted Seismic Exploration Without Physical Entry*, 68 Baylor L. Rev. 797, 799 (2016).

[79] *See id.* at 799–800. Wildcatting refers to drilling in unexplored or unproven areas. *See Wildcat Drilling – Definition and Meaning*, Mkt. Bus. News, https://marketbusinessnews.com/financial-glossary/wildcat-drilling-definition-meaning/ [https://perma.cc/98GD-J4H3] (last visited Oct. 2, 2019).

[80] McFarland, *supra* note 76.

[81] *See* Mosmeyer, *supra* note 78, at 800.

[82] *See* Henry Lyatsky, *Gravity and Magnetic Geophysical Methods in Oil Exploration*, Hart Energy (Oct. 3, 2016), https://www.epmag.com/gravity-and-magnetic-geophysical-methods-oil-exploration-1364421 [https://perma.cc/GF2V-3XE8].

rock formations varies with their density.[83] Gravity surveying seeks to identify anomalies from the values that would be expected if the earth was more uniform.[84] Negative anomalies occur where rocks have a lower than expected density, reducing their gravitational pull on the surface.[85] Similarly, positive anomalies indicate the presence of higher density rock due to its higher than expected gravitational pull.[86]

Oil and gas are typically found in nonmagnetic sedimentary rock rather than highly magnetized igneous and metamorphic rocks.[87] Thus, magnetic surveying works in a similar fashion to gravity surveying, mapping positive and negative variances from the expected level of magnetization of subsurface rock formations.[88]

Although both gravity and magnetic surveying are often considered as auxiliary techniques rather than a reliable replacement for seismic surveys, they have an important distinguishing characteristic—both can be performed without any physical presence on the ground.[89] Today it is common practice to fix gravimeters and magnetometers to small airplanes and conduct these surveys aerially.[90] This ability has significantly reduced the cost and environmental impact of these surveys by allowing quick coverage of large areas, uninhibited by the terrain.[91]

C. Current and Potential Future Uses of Drones in Oil and Gas Exploration

Currently, the most widespread use of drones in the oil and gas the industry is for infrastructure inspection.[92] But drones are also starting to play a critical role in exploration operations, whether they be seismic, magnetic, or gravity surveys.

Although seismic surveys cannot be performed aerially, drones still have a significant role to play in seismic operations.

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[83] Petty, *supra* note 72.
[84] Lyatsky, *supra* note 82.
[85] *Id.*
[86] *Id.*
[87] Petty, *supra* note 72.
[88] *See id.*
[89] *See* Lyatsky, *supra* note 82.
[90] *See* Petty, *supra* note 72.
[91] *See* Lyatsky, *supra* note 82.
[92] *See* Chris Leightell, *How Drones Will Transform the Oil and Gas Industry in 2018*, Droneblog (June 16, 2017), https://www.droneblog.com/2017/06/16/how-drones-will-transform-the-oil-and-gas-industry-in-2018/ [https://perma.cc/4PKP-QNKW].

Topography, weather, and infrastructure all pose significant challenges in both the planning and operational stages of seismic surveys.[93] These factors can make placing, inspecting, and retrieving receivers both dangerous and time consuming for the crew involved.[94]

Drones offer a solution to these challenges, both reducing risk and improving efficiency.[95] For example, a drone equipped with a high-definition camera can inspect a hard to reach area with relative ease.[96] And, drones can continue to operate in dangerous weather that would otherwise result in costly delays.[97] Because they are capable of transmitting images in real time, drones also improve safety and efficiency by allowing inspections to be performed from a central location so that personnel are only deployed to the locations where they are actually needed.[98]

The ability to communicate in real time has other significant benefits. Drones can monitor weather conditions and other noise-creating sources during a survey and quickly alert operators that the survey may need to be paused or restarted.[99] Perhaps most importantly, drone-mounted radio transceivers can collect data from receivers and transmit it back to base so that data can be analyzed faster.[100]

Future UAS technology may even make human involvement in receiver set-up and monitoring completely unnecessary. French supermajor Total is developing receivers it calls Downfall Air Receiver Technology (DARTs).[101] When dropped from drones, the DARTs anchor into the ground in an upright position.[102] Data collected during a survey can then be transmitted to intermediate antennas and onto a central processing location in real time, via a high-speed radio telemetry system.[103] Once survey operations are complete, there is no need to retrieve the DARTs because they are made of a completely biodegradable

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[93] Lopez & Caldwell, *supra* note 4.

[94] *See id.*

[95] *Id.*

[96] *Id.*

[97] *Id.*

[98] *See id.*

[99] *Id.*

[100] *See id.*

[101] Jane Whaley, *DARTs and Drones: The Future of Onshore Seismic*, 15 GEO EXPRO, no. 2, 2018, at 14, 14, https://www.geoexpro.com/articles/2018/04/the-future-of-onshore-seismic [https://perma.cc/62A2-ZXQC].

[102] *Id.*

[103] *Id.* at 15.

plastic and utilize batteries and sensors designed to have a negligible environmental impact.[104]

Successful research has also been conducted on the feasibility of an integrated system where a geophone is mounted to the bottom of the drone itself.[105] Using a prototype with four geophones fixed to the bottom of a drone, a study was conducted to compare the data received by the drone system to data gathered by planted geophones in three different soil environments: grass, sand, and dry clay.[106] Although there was slightly more noise in the drone-based system's data and it encountered some difficulty penetrating the clay, ultimately the study concluded that the data recorded by the drone system was similar in quality to the data recorded by planted geophones,[107] which indicates a commercially viable system is not far off.

Systems like the DARTs and the integrated drone-mounted geophone have obvious safety and efficiency advantages and have the potential to reduce the cost of seismic surveying significantly. Further, less human involvement is better from an environmental perspective because there will be fewer disturbances to wildlife and less alteration of the land to accommodate entry.[108] In situations where the surface is used for ranching or farming, this could prove invaluable. By substantially eliminating the need for humans and vehicles to access receiver sites,[109] UAS can significantly reduce damage to crops and pastures, which promises to facilitate the ability to obtain and reduce the cost of exploration permits for these lands.

Drones can also be used to conduct magnetic surveys and provide significant advantages over a survey performed on the ground or by airplane.[110] Like airplanes, drones can cover large areas much faster than operators on the ground, with one article stating it would take an operator on the ground ten days to

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[104] *Id.*

[105] Robert R. Stewart et al., *An Unmanned Aerial Vehicle with Vibration Sensing Ability (Seismic Drone)*, 2016 SEG TECHNICAL PROGRAM EXPANDED ABSTRACTS 225, 225.

[106] *Id.* at 226–27.

[107] *Id.* at 227–28.

[108] *See* Lopez & Caldwell, *supra* note 4.

[109] Lucas Satterlee, *Climate Drones: A New Tool for Oil and Gas Air Emission Monitoring*, 46 ENVTL. L. REP. 11069, 11070 (2016).

[110] João Antunes, *How Are High-Quality Magnetometer Technologies Being Used on UAVs?*, COMM. UAV NEWS (Sept. 11, 2018), https://www.expouav.com/news/latest/how-are-high-quality-low-cost-magnetometer-technologies-being-used-on-uavs/ [https://perma.cc/Y2ZN-E2FZ].

cover what a drone survey could cover in one.[111] Drones also have the advantage of minimizing noise that would otherwise be created by a ground operator's movements.[112]

However, unlike airplanes, FAA regulations do not require drones to maintain a minimum altitude of 300 feet.[113] This is important with respect to gravity surveys because the data collected improves the closer the magnetometer is to the ground.[114] Further, drone-based magnetometers require less work to launch, land, and re-energize than airplanes and can still operate in inclement weather and at night because no life is at risk.[115]

For gravity surveys, drones will enjoy those same benefits and more, thanks to a recent breakthrough in gravimeter technology. The new microelectromechanical (MEMS) gravimeter has drastically reduced both the size and weight of the system from what was previously available.[116] Whereas previous gravimeters were about the size of a shopping basket and weighed multiple pounds, the new system, with all its electronics, will be ultra-light and about the size of a tennis ball.[117] And, the new system is also much less expensive than current gravimeters, which cost around $100,000.[118] Equipped with this new technology, it is hard to see a scenario where drone-based systems are not the preferred method for gravity surveying moving forward.

IV. A PROPERTY AND CONTRACT PERSPECTIVE: TRADITIONAL OIL AND GAS LAW APPLIED TO UAS

The right to explore for oil, gas, and other minerals is a legally protected property right, irrespective of the ownership theory a particular state adopts.[119] If geophysical operations are performed without permission from a holder of the exploration

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111 *Id.*

112 *Id.*

113 *See id.*; *see also* 14 C.F.R. § 107.51 (2016).

114 Antunes, *supra* note 110.

115 *See id.*

116 *See* Prachi Patel, *Stamp-Size Gravity Meter Could Have Big Impact on Oil Exploration*, IEEE SPECTRUM: ENERGYWISE (Mar. 30, 2016), https://spectrum.ieee.org/energywise/energy/fossil-fuels/stampsized-gravity-meter-could-have-big-impact-on-oil-exploration [https://perma.cc/32KJ-NG8F].

117 *Id.*

118 *Id.*

119 Anderson, *supra* note 77, at 140.

right,[120] the owner or owners of that right may be able to recover for the wrongful intrusion on one or more tort theories.[121] However, applying the law in this area is rarely straightforward because of its strict requirements and because it was developed during an era utilizing technology that has long since become outdated.[122] Drones pose yet another challenge, and present laws are likely insufficient to address it.

A. Subsurface Rights: Trespass and Assumpsit Theories as the Basis for Geophysical "Trespass"

In the simplest case, if a party physically enters upon another's land without permission and conducts exploration operations, an actionable geophysical trespass has been committed.[123] This would of course constitute a trespass at common law as well, with perhaps the only difference being the manner in which damages are calculated.[124] However, the facts are rarely this clear cut.

Three Texas cases are key to understanding the basic protection against wrongful intrusion upon a mineral estate: *Kennedy v. General Geophysical Co.*,[125] *Phillips Petroleum Co. v. Cowden* (*Cowden I*),[126] and *Phillips Petroleum Co. v. Cowden* (*Cowden II*).[127] In *Kennedy*, General Geophysical approached the plaintiff requesting permission to conduct seismic surveys on his land, and the plaintiff denied permission to use his land or the public road adjoining it without compensation.[128] General Geophysical proceeded to shoot 2-D seismic on the road anyway, coming as close as ten to fifteen feet from the plaintiff's land, but with no straight line

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[120] Identifying the owner of the right to explore and any others from whom permission must be obtained can be a difficult exercise. Some of the contributing reasons include: (1) severance of the mineral interest from the surface interest; (2) severance, division, and fractionalization of the mineral interest itself; and (3) provisions in a lease or other agreement and restrictive covenants in a conveyance requiring notice to, or consent from, a party not involved in contracting for or performing geophysical services. *See id.* at 144–61.

[121] *Id.* at 141–44.

[122] *Id.* at 138.

[123] *Id.* at 141–42.

[124] Because state laws and the legal theories allowing for recovery differ, damages will necessarily depend on the jurisdiction where the wrongful intrusion occurred. *See id.* at 141 & n.13.

[125] Kennedy v. Gen. Geophysical Co., 213 S.W.2d 707 (Tex. App.—Galveston 1948, writ ref'd n.r.e.).

[126] Phillips Petroleum Co. v. Cowden (*Cowden I*), 241 F.2d 586 (5th Cir. 1957).

[127] Phillips Petroleum Co. v. Cowden (*Cowden II*), 256 F.2d 408 (5th Cir. 1958).

[128] *Kennedy*, 213 S.W.2d at 708–09.

from shot point to receiver set ever crossing onto the land itself.[129] The court affirmed denial of the plaintiff's trespass claim because no physical entry occurred, holding that entry of the vibrations caused by shooting alone was insufficient.[130]

In the *Cowden* cases, the owner of a severed surface estate permitted an exploration company to enter a portion of the land and shoot seismic in order to analyze a neighboring tract owned by a third party.[131] The Fifth Circuit held this constituted an invasion of the rights of the severed mineral owners, even though the physical entry upon the surface was not in and of itself a trespass.[132] The court explained that, unless altered by some agreement, the right to grant use of the surface above minerals for their exploration lies exclusively with the mineral owners.[133] It reasoned that because "inevitably any test carried out to obtain information about neighboring property will be still more informative about the site of the test itself," the surface owner has a "concurrent but not an exclusive right" to deny use of the surface to explore a neighboring tract but no right to unilaterally permit it.[134] Interestingly, by characterizing the right as "concurrent," the court also limited the rights of mineral owners in that they cannot unilaterally permit use of the surface to explore a neighboring tract either.[135]

In *Cowden*, as in *Kennedy*, there was no physical entry upon the land comprising the mineral estate itself.[136] However, Texas law allows a mineral owner to recover the "reasonable market value" to him of the invading party's wrongful use and occupation of his property based in assumpsit, rather than trespass.[137] Thus, the physical entry upon the surface, although not a trespass as to the surface owner, was sufficient to sustain an action for geophysical trespass brought by the mineral owners.

The proper measure of damages was determined to be the per-acre rate the exploration company would have paid the plaintiffs for the right to explore, calculated only on the acreage

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129 *See id.* at 709.

130 *Id.* at 711, 713.

131 *Cowden I*, 241 F.2d at 588–89.

132 *See id.* at 591–92.

133 *See id.*

134 *Id.* at 590–91.

135 Karolyn King Gillespie, *Sizing Up Seismic: Can You Get What You Want and Use What You Get?*, 54 ROCKY MT. MIN. L. INST. 29-1, § 29.03[1] (2008).

136 *Cowden I*, 241 F.2d at 588.

137 *Id.* at 592–93.

actually "occupied" in conducting the survey.[138] For seismic surveys, "such area would include the areas from which vibration echoes were actually received" and "such additional areas for which the trespasser would have had to obtain licenses from a hypothetically 'reasonable' mineral estate owner, if it had conducted the actual operation without trespassing."[139]

Following *Kennedy*, it was believed that dicta in the opinion emphasized that the "plaintiff failed to prove that the defendant obtained reliable information" about the structure underneath his land, leaving open the possibility for an actionable geophysical trespass without physical entry.[140] However, this theory has lost much of its teeth since the decision in *Villareal v. Grant Geophysical, Inc.*, in which the San Antonio Court of Appeals, citing *Kennedy* and *Cowden*, held a claim for geophysical trespass could not be sustained without physical entry.[141] It appears that most, if not all, jurisdictions are only willing to award damages under a trespass-type theory if there has been physical entry, and commentators have exhaustively discussed the problems associated with this requirement.[142]

Advances in seismic surveying technology have strained the ability to apply the rules pronounced in cases like *Kennedy*. Unlike the 3-D seismic world that oil and gas companies operate in today, the seminal Texas cases discussed above dealt with straight-line 2-D seismic. Because 3-D seismic is significantly more reliable for identifying productive formations and 3-D surveys generally cover much larger areas than 2-D surveys, issues have arisen.[143]

For example, if the surveys in *Kennedy* were 3-D, a three-dimensional image could be used to make a much more accurate prediction of the geology extending into the neighboring tract

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[138] Phillips Petroleum Co. v. Cowden (*Cowden II*), 256 F.2d 408, 409 (5th Cir. 1958).

[139] *Id.*

[140] *See* Harry L. Blomquist III, *Geophysical Trespass? The Guessing Game Created by the Awkward Combination of Outmoded Laws and Soaring Technology*, 48 BAYLOR L. REV. 21, 26 (1996).

[141] *See* Villarreal v. Grant Geophysical, Inc., 136 S.W.3d 265, 269–70 (Tex. App.—San Antonio 2004, pet. denied); *see also* Gillespie, *supra* note 135, § 29.03[3].

[142] *See, e.g.*, Blomquist, *supra* note 140, at 28; *cf.* Anderson, *supra* note 77, at 141–44.

[143] Blomquist, *supra* note 140, at 30–31.

than a 2-D survey.[144] If the prediction indicated unfavorable prospects, land might go unleased that would have been leased but for the survey results.[145] As reaffirmed by *Villareal*, the owner of the mineral estate would not be able to recover in trespass or assumpsit because there was no physical entry.[146]

The issue is exacerbated if exploration permits are obtained on multiple borders of a mineral estate as part of a large-scale survey, especially if acreage of the unpermitted mineral estate is small relative to the total permitted land. This is essentially what occurred in *Villareal*.[147] The survey there was planned to cover approximately 300 square miles, and the exploration companies paid out nearly $4 million to consenting surface and mineral owners within the survey area.[148] Even though the survey collected data relating to the minerals underlying the Villareals' land, recovery was denied under both trespass and assumpsit because no physical entry upon their land ever took place.[149] The court did, however, bemoan that "it appears that Texas law regarding geophysical trespass has not kept pace with technology."[150]

The expanding use of drones raises some interesting possibilities with respect to geophysical trespass. One of the benefits drones offer over human actors is precision GPS guidance.[151] This could prove incredibly advantageous for operators seeking to exploit the physical entry loophole permitted by caselaw. GPS-equipped drones would allow operators to place receivers within inches of the boundary line separating permitted and unpermitted land with near certainty that physical entry does not occur.[152] Thus, relying on *Kennedy* and *Villareal*, companies

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144 *See* Kennedy v. Gen. Geophysical Co., 213 S.W.2d 707, 709–10 (Tex. App.—Galveston 1948, writ ref'd n.r.e.). Dicta in *Kennedy* stated that the data gathered from the surveys "could be used to extrapolate the geology of adjacent acreage without liability." Anderson, *supra* note 77, at 162–63 (citing *Kennedy*, 213 S.W.2d at 709).

145 *See* Blomquist, *supra* note 140, at 29–30.

146 *Villarreal*, 136 S.W.3d at 269–70; *see also* Gillespie, *supra* note 135, § 29.03[3].

147 *Villarreal*, 136 S.W.3d at 267.

148 *Id.*

149 *Id.* at 267, 270. The court also denied a claim for unjust enrichment, holding that because no trespass occurred, the exploration companies "did not wrongfully secure a benefit nor did they passively receive one which would be unconscionable to retain." *Id.* at 270.

150 *Id.*

151 Lopez & Caldwell, *supra* note 4.

152 Gillespie, *supra* note 135, § 29.02.

could easily extrapolate the geology of window tracts without risk of liability for geophysical trespass.[153]

Of course, mineral owners can easily avoid having their pockets turned out in this way by simply accepting an exploration company's permit offer rather than holding out for a better one. But, if enough owners start taking the first offer available fearing they will otherwise walk away empty-handed, this will have an adverse effect on mineral owners in the long-run by driving down the compensation offered for exploration permits. On the other hand, allowing permit prices to depress by maintaining a bright-line physical-entry requirement to establish liability furthers the public interest in the efficient development of domestic oil and gas resources.[154]

Conversely, UAS could also become the basis for inadvertent geophysical trespass liability in these situations. Because *Causby* carved out an exception that entry into the airspace below the NAS may constitute a trespass,[155] a drone that enters that space above an unpermitted tract due to careless piloting may be enough to constitute physical entry. If other courts share the feelings of the *Villareal* court that current geophysical trespass precedent provides inadequate protection in light of modern technology,[156] they may warmly receive a theory claiming physical entry based on low-airspace flight.[157] Thus, rather than finding out how a court would rule, operators should be diligent in ensuring that drones only operate below the NAS over permitted land.

B. Legal Grey Area: Aerial Gravity and Magnetic Surveying

Aerial surveying has further strained the outdated geophysical trespass jurisprudence. As discussed above, gravity and magnetic surveys can now be performed over large areas by mounting gravimeters and magnetometers to small planes. This poses obvious problems for landowners bringing trespass actions based on the

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153 *See* Blomquist, *supra* note 140, at 31 (explaining that a "window" tract refers to an unpermitted tract around permitted land).

154 *See* Anderson, *supra* note 77, at 172–73, 184.

155 *See* Farber, *supra* note 16, at 384–87.

156 Villarreal v. Grant Geophysical, Inc., 136 S.W.3d 265, 270 (Tex. App.—San Antonio 2004, pet. denied).

157 *See* Farber, *supra* note 16, at 381–82.

physical entry requirement because airplanes operate almost exclusively in the NAS.[158]

The most instructive case for approaching the problem from a trespass or assumpsit point of view is *Gulf Coast Real Estate Auction Co. v. Chevron Industries, Inc.*[159] During ongoing negotiations for a uranium option lease, Chevron conducted aerial surveys over the subject land without the consent of Gulf Coast.[160] Gulf Coast subsequently brought an action on an assumpsit theory, seeking damages for the reasonable value of *exploration activities.*[161] Ultimately, the Fifth Circuit denied recovery because Gulf Coast had failed to produce any evidence of the value of the right to explore.[162] The evidence Gulf Coast did present pertained only to the option-lease agreement negotiations, which the court determined was indicative of the reasonable value for that type of agreement but not for the right to explore standing alone.[163]

Because recovery was denied on the basis that the evidence was insufficient to establish a reasonable value, commentators have maintained that the Fifth Circuit in *Gulf Coast Real Estate* did in fact recognize a cause of action for wrongful intrusion by aerial surveying.[164] Indeed, the court stated that if Gulf Coast had "produced evidence that the value of the right to explore should be measured by the option-lease agreement price on the theory that an option to explore without the subsequent possibility of a lease was valueless," then *Cowden* damages might have been awarded.[165]

It appears that no new cases addressing aerial surveying from a trespass or assumpsit point of view have reached the appellate level since *Gulf Coast Real Estate* in 1982.[166] Thus, although the

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158 *See id.* at 382–83; Anderson, *supra* note 77, at 168.

159 665 F.2d 574 (5th Cir. 1982).

160 *Id.* at 575. An option lease is an agreement under which the prospective lessor acquires permission explore as well as an option to lease the minerals based on predetermined terms. Blomquist, *supra* note 140, at 30–31.

161 *Gulf Coast Real Estate*, 665 F.2d at 575.

162 *Id.* at 576.

163 *Id.*

164 *See, e.g.*, Blomquist, *supra* note 140, at 32–33 (citing *Gulf Coast Real Estate*, 665 F.2d at 575).

165 *Gulf Coast Real Estate*, 665 F.2d at 576.

166 A more recent case addressing the issue was heard before a Texas district court, but was settled before reaching the appellate level. Blomquist, *supra* note 140, at 33–34 (citing BGM Airborne Surveys, Inc. v. Coppock, No. 92-CI-13993 (288th Dist. Ct., Bexar County, Tex. Oct. 6, 1992)).

case tenuously stands for the existence of a cause of action based on these theories, many commentators believe a better approach is an action grounded in common law privacy torts or trade secret law.[167] Perhaps the best protection is offered by Texas statutory law, as will be discussed further below.

C. Surface Rights: Implied Protections

A surface owner often lacks the exclusive right to grant permission to explore the mineral estate.[168] Because the rights of surface owners and mineral owners are frequently in conflict, limited protections are afforded to the surface estate even though it is servient to the mineral estate.[169]

In general, the owner of a severed surface estate has no right to receive compensation or notice for, and cannot interfere with, use of the surface in connection with the mineral owner's exercise of the exploration right.[170] The position of the lessor to a lessee is similar. Unless the lease provides otherwise, the lessor is not entitled compensation because the mineral lease includes the exploration right, and the lessor may not interfere with the lessee's use.[171] However, this does not mean that the scope of permissible surface uses for exploration is unlimited. A mineral owner or lessee exercising the exploration right cannot use the surface in a negligent or excessive manner to conduct operations.[172] Some leases attempt to clarify what constitutes acceptable use, but the implied standard is that of a reasonable operator acting "in accordance with the accepted custom and practice of the oil and gas industry."[173] Damages are generally awarded only for a decline in value of the land due to injury

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[167] *See, e.g.*, Blomquist, *supra* note 140, at 47–49; Mosmeyer, *supra* note 78, at 812–16. Appropriation of trade secrets as an alternative theory is beyond the scope of this Comment.

[168] Common reasons for this bifurcation of ownership include: (1) a lease conveying the exploration right to the lessee; (2) severance of the surface estate and the mineral estate via some other conveyance; and (3) mineral interests owned in cotenancy, where the surface owner cotenant in the mineral estate does not own a large enough fractional interest to prevent the others from permitting exploration or leasing the minerals in those few jurisdictions that require consent from a cotenant with a majority share of the mineral rights. *See generally* Anderson, *supra* note 77, at 145–46, 150–51.

[169] *See* Gillespie, *supra* note 135, § 29.03[1].

[170] *See* Anderson, *supra* note 77, at 180

[171] *See id.* at 180–81.

[172] *Id.* at 181.

[173] *See id.*

caused by breach of the standard of use, but damages have also been awarded for mental anguish.[174]

However, as drones continue to be integrated into oil and gas exploration operations, any attempt to claim their use as excessive is destined to fail. Realistically, drones decrease the burden imposed by exploration because the land will undoubtedly endure less physical change and destruction if a drone is used to perform a task that would otherwise have to be performed by a person in his or her truck.[175] And, while an action seeking damages for injury to the land that is based in negligence with regard to the manner in which drones are used has theoretical viability, it lacks practical usability. Almost certainly, a surface owner would be able recover if a drone crashes and inflicts damage.[176] But it is hard to imagine what damage a UAS weighing less than fifty-five pounds could cause that would be substantial enough to require litigating the issue rather than the exploration company, or whomever contracted it, simply reimbursing the surface owner for any costs.

Most jurisdictions have also adopted the "accommodation doctrine" to further protect the rights of surface owners.[177] As applied to exploration activities by the North Dakota Supreme Court, accommodation may be required when: (1) the existing method of exploration would interfere with or preclude an existing use of the surface estate; and (2) some reasonable alternative method of established industry practice is available that would not interfere with the existing use.[178] Under that court's version of the test, once the surface owner proves the existence of a reasonable alternative, "a balancing of the mineral and surface owner's interest [is required]."[179]

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[174] *See id.* at 181–82; *see also* Teledyne Expl. Co. v. Klotz, 694 S.W.2d 109, 110–11 (Tex. App.—Corpus Christi–Edinburg 1985, writ ref'd n.r.e.) (holding compensation for mental anguish was proper because the exploration company bulldozing a sendero to run a seismic line constituted an intentional tort). It is important to note the award of damages was only sustained because the plaintiff established the trespass was willful and thus was an intentional tort. *Teledyne*, 694 S.W.2d at 110–11.

[175] *Cf.* Lopez & Caldwell, *supra* note 4.

[176] *See* Anderson, *supra* note 77, at 182.

[177] *See id.*; *see also* Gillespie, *supra* note 135, § 29.03[2][a] & n.87 (citing Getty Oil Co. v. Jones, 470 S.W.2d 618, 622 (Tex. 1971)) (stating that states adopting the accommodation doctrine include Arkansas, New Mexico, North Dakota, Texas, Utah, and West Virginia).

[178] Gillespie, *supra* note 135, § 29.03[2][a] (citing Hunt Oil Co. v. Kerbaugh, 283 N.W.2d 131, 137 (N.D. 1979); *Getty Oil*, 470 S.W.2d at 622).

[179] *Kerbaugh*, 283 N.W.2d at 137.

Though the North Dakota court in *Kerbaugh* ultimately held there was no evidence of a reasonable alternative to seismic surveying itself,[180] it is reasonable to assume that the accommodation doctrine may still be invoked to require an exploration company to adjust the manner in which it conducts seismic surveys.[181] Understandably, a surface owner would be concerned about being recorded during a planned survey that will involve the use of a fleet of monitoring drones to provide real-time updates on weather and noise conditions and to inspect receivers. In the extreme case, this could drive a landowner to shut the blinds and refuse to go outside throughout the duration of survey operations. Such a reaction, though probably unreasonable, might be considered evidence of interference with the owner's use of the land.[182] And there are certainly alternatives to drones available that would not cause this interference and that are the actual established industry practice.

A stronger case may exist if drones are to be used in connection with a survey of a more densely populated area rather than a rural one.[183] For example, a landowner who has a receiver placed in his or her backyard may refuse to use it out of fear that, at any moment, a drone may swoop in and record whatever he or she is doing. While there is a similar risk that a human technician might stumble upon a landowner in a compromising or embarrassing situation, that risk may be perceived as lower because humans are less inconspicuous than drones and anything stumbled upon would live on only in the person's mind rather than a lasting image or video recording.

On the other hand, a landowner's use may actually be interfered with less when drones are used. Whereas parents might not allow their children to be in the yard unsupervised out of concern for their safety because a human technician may come by, if the landowners can negotiate an agreement with the exploration company where it will inspect receivers using drones and notify the owners before sending someone out in-person, that would seem to cure this concern. Thus, although it is questionable whether a court would accept the accommodation doc-

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[180] *See id.* at 137, 139–40.

[181] Anderson, *supra* note 77, at 182–83.

[182] *But see* Ottis v. Haas, 569 S.W.2d 508, 514 (Tex. App.—Corpus Christi–Edinburg 1978, writ ref'd n.r.e.) (holding surface owner must raise "more than a question of inconvenience" to invoke the accommodation doctrine).

[183] *See* Anderson, *supra* note 77, at 183.

trine as a means to prevent drones from being used in connection with exploration activities, at the very least, it has the potential to be useful in negotiating an agreement on how drones are to be used.

D. Protecting the Surface by Contract

The rules discussed in subsection C are merely the default standards courts apply in the absence of expressions in a contractual agreement. However, because geophysical exploration can have an intense impact on the surface, 3-D seismic surveys especially, it is best not to leave interpretation of the implied protections to chance and to instead address the issue specifically.[184] By specifically addressing drones prior to operations, negotiated contractual agreements can serve as an effective tool for preventing costly disputes and disruptions that might arise in their absence.

When the surface owner holds the exclusive exploration right, bargaining power in negotiations for a lease, option lease, or seismic exploration is at its highest.[185] A surface owner that is especially concerned with privacy can simply refuse to enter an agreement that does not contain a provision expressly prohibiting the use of drones in connection with operations. Conversely, a surface owner concerned with damage to the land might insist that an exploration company utilize drones to reduce the intensity of surface operations.

It is also common practice in many states for operators to obtain surface use permits or damage releases even when the surface owner does not hold the exclusive exploration right.[186] Though their bargaining power is significantly lower in these situations, since the operation will likely proceed irrespective of whether an agreement is reached,[187] surface owners may still be able to negotiate more limited protections.

For example, if privacy is the primary concern, a surface owner might ask for a promise that if UAS are used in connection with the survey, UAS will maintain a minimum distance from the surface owner's residence. In addition, or in the alternative, a surface owner might request a provision requiring the exploration company to destroy photographs or video record-

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184 *See* Gillespie, *supra* note 135, § 29.05.
185 *See* Anderson, *supra* note 77, at 151 n.58.
186 *See id.* at 181.
187 *See id.* at 180.

ings of the property within a reasonable time after completion of the operation and prohibiting their disclosure to third parties. Companies may do this anyway as a matter of standard operating procedure,[188] so there would be little reason to protest.

On the other hand, if intensity of surface use is the primary concern, bargaining power may remain high because the surface owner is less motivated to agree to a release, and the exploration company should be more motivated to obtain one. Thus, although a surface owner in this situation cannot prevent operations, it is likely that an exploration company possessing even a limited capability to use drones would agree to deploy them in order to secure a release. At the very least, if an agreement cannot be reached after this point is raised during negotiations, it may serve as damning evidence of the operator's negligence if a significant injury to the land actually occurs.

Carefully drafted and negotiated agreements also help exploration companies mitigate liability risk.[189] If a company is planning to use UAS in connection with an operation, it should disclose this fact in any agreement it enters into with surface and mineral owners. Making this disclosure may complicate negotiations and slow down the pre-operations process, but the benefits likely outweigh those costs. Landowners will be much less likely to cause problems over drones if given prior notice they may be used. Further, if problems do arise over the use of drones and eventually lead to litigation, the exploration company can rely on the agreement to show the landowner gave consent.

V. A TORT PERSPECTIVE: PRIVACY LAWS APPLIED TO UAS

The limitations that privacy rights impose on government action are one of the hallmarks of American freedom. But privacy rights in the purely civil context are equally important to the fabric of American society, and the social and economic benefits that meaningful privacy creates must be protected.[190]

When evaluating a liability framework for privacy violations involving UAS, commentators have repeatedly turned to the common law causes of action for intrusion upon seclusion and

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[188] *Cf.* Gillespie, *supra* note 135, § 29.05.

[189] *See id.*

[190] *See generally* Hazel, *supra* note 6, at 360–61 (discussing the economic benefits of protecting privacy).

for publication of private affairs.[191] Privacy harms can be broken into two components: subjective and objective.[192] Subjective privacy harm occurs when a person perceives he or she is the subject of unwanted surveillance, irrespective of whether the person is actually being observed.[193] Objective privacy harms are the adverse consequences of a person's private information being used against him or her.[194] Intrusion upon seclusion actions largely protect against subjective privacy harm, whereas actions against publication of private affairs protect against objective privacy harm.[195]

A. Intrusion Upon Seclusion

The two basic requirements for intrusion upon seclusion under the Restatement (Second) of Torts approach are: (1) an *intentional* intrusion upon a person's solitude, seclusion, or private concerns; and (2) the intrusion "would be highly offensive to a reasonable person."[196] Comments to the Restatement further provide that publication has no consequence in establishing intrusion upon seclusion and that an intrusion need not be physical, but it can be.[197]

At first blush, intrusion upon seclusion appears to afford property owners at least some meaningful protection, but numerous limitations have made it increasingly difficult for plaintiffs to succeed on the theory. One of the biggest hurdles is intent.[198] The requirement is easily satisfied in the case of a recreational user flying a drone up to the window of a person's house to try to get a look inside. But an instance where a monitoring drone pilot deviates from normal inspection during a survey to take a look inside a surface owner's home seems highly improbable. A much more likely scenario is one where a drone, in the normal course of operations, inadvertently or incidentally captures an image or records a video of some private matter. But, in this scenario, there would be no redress for intrusion

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[191] *See, e.g.*, Farber, *supra* note 16, at 396; John Villasenor, *Observations from Above: Unmanned Aircraft Systems and Privacy*, 36 Harv. J.L. & Pub. Pol'y 457, 500–05 (2013).

[192] M. Ryan Calo, *The Boundaries of Privacy Harm*, 86 Ind. L.J. 1131, 1142 (2011).

[193] *Id.*

[194] *Id.* at 1143.

[195] *See* Villasenor, *supra* note 191, at 501, 503.

[196] Restatement (Second) of Torts § 652B (Am. Law Inst. 1977) (emphasis added).

[197] *Id.* § 652B cmt. b.

[198] *See* Farber, *supra* note 16, at 396–97.

upon seclusion because accidental or innocent intrusions are non-actionable.[199]

Still, it is exceedingly unlikely an aggrieved person would be any less upset or embarrassed simply because his or her privacy was violated as an unintended consequence of exploration activities taking place on the property. The subjective harm—knowledge or mere perception of unwanted observation—is felt the same, regardless of intent.[200]

B. Publication of Private Matters

Alternatively, a separate cause of action exists for what the Restatement (Second) of Torts terms "[p]ublicity given to private life."[201] An action lies where: (1) a private matter is publicized; (2) publication of that matter "would be highly offensive to a reasonable person"; and (3) it is "not of legitimate concern to the public."[202] Comment a to section 652D expands on the meaning of "publicity," explaining that it requires the matter be communicated to the public or to so many people that it is almost certain to become public knowledge.[203] It expressly states disclosure to a single person or even a group is insufficient.[204]

Unless courts relax the publicity requirement and extend coverage to mere disclosure, a possibility suggested in the Restatement,[205] the usefulness of the publication tort for surface owners is somewhat limited. Even if communication occurs, it is non-actionable unless it reaches a sizeable enough group that the matter would essentially be public knowledge. Suppose an exploration company enters into a confidentiality agreement with a third party and later discloses topographical maps, images of the property, and survey results generated with the aid of UAS. A surface or mineral estate owner would likely be powerless, even when the material shared implicates private affairs and a reasonable person would find publication highly offensive. Limited disclosure in this manner alone, even if it is harmful, is insufficient to give rise to an actionable tort for publication of private affairs.

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199 *See id.* at 397.

200 *Cf.* Calo, *supra* note 192, at 1143–45.

201 Restatement (Second) of Torts § 652D.

202 *Id.*

203 *Id.* § 652D cmt. a.

204 *Id.*

205 *See id.*

However, the absence of an intent requirement[206] creates a risk of inadvertent liability for dissemination of private facts if exploration companies are careless. Suppose an exploration company posts images captured by drones during a recent survey operation to its website or social media page[207] to promote the ways in which the company is using new technology to improve efficiency and reduce the environmental impact of its operations. Because the images were shrunk down, the employee posting them fails to notice they show something unflattering or damning about the property or its owners in area in which they had a reasonable expectation of privacy. Now in the public domain, the private matter is discovered by a large number of people before the exploration company can remove it, and the owners are humiliated and suffer mental distress as a result.

In such a situation, a plaintiff would almost certainly make out a prima facie case for publication of private life.[208] And, the same could occur where the images are included as part of a presentation to investors or an industry association, are used in connection with a television interview of an executive of the exploration company, or are placed in a magazine article intended to promote the technology. Because of this risk, companies ideally would avoid the publication of images altogether. But, if there is to be anything short of total nondisclosure, general counsel should be aware of these risks and emphasize the need to exercise caution in selecting the images to be used. Further, it may be advisable to just obtain permission from the landowners before publication of any images related to their property occurs.

C. Privacy Under the Texas Drone Statute

The Texas drone privacy statute offers a substantial upgrade over the general common law causes of action under the Restatement, but it is also not without its limits. Section 423.006 of the Texas Government Code provides an express civil right of action for a violation of the criminal offenses in sections 423.003

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[206] *See id.* § 652D.

[207] *See* Farber, *supra* note 16, at 403 (citing Moreno v. Hartford Sentinel, Inc., 91 Cal. Rptr. 3d 858, 862 (Cal. Ct. App. 2009)) (explaining that courts have held that social media postings open up information to the public, even despite features potentially limiting the audience).

[208] Restatement (Second) of Torts § 652D.

and 423.004.[209] Section 423.003 is analogous to intrusion upon seclusion and section 423.004 to the publication violation.[210]

Under the statute's version of intrusion upon seclusion, an actionable offense requires: (1) use of a drone to capture an image of an individual or private real property; and (2) intent to conduct surveillance on the subject of the image captured.[211] The standard for intent requires that an offender acts with the "conscious objective or desire to engage in the conduct or cause the result."[212] The intent requirement presents the same hurdle to recovery that intrusion upon seclusion does under the Restatement. With nothing more, landowners will still be without redress in situations where a monitoring drone inadvertently captures an embarrassing image. However, because the definition of "image" includes sound waves and other electromagnetic waves, it appears to finally fill in the gap in geophysical trespass jurisprudence concerning aerial surveys.[213]

Consider again the situation where a drone is used to conduct a low-airspace gravity or magnetic survey without the consent of the mineral owner. Under the Texas statute, this could constitute a Class C misdemeanor, and the landowner would be entitled to a $5,000 award—even if the survey results were not disclosed—because the survey captured an "image" in the form of electromagnetic waves.[214] There will also be liability if a drone is used to photograph or gather data to create a topographical map of land in connection with the prospect of obtaining a seismic permit or an option lease on a tract.[215]

Presumably, images captured from above 500 feet (i.e., the NAS) are non-actionable because common law intrusion upon seclusion cannot be committed when observing from a public space.[216] However, FAA regulations help mitigate this loophole because they impose a maximum operational height for UAS of 400 feet.[217] And, although the sole purpose of the Small UAS Rule was to address safety, the FAA discussed privacy concerns in

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[209] TEX. GOV'T CODE ANN. §§ 423.003, .004, .006.

[210] *Id.* §§ 423.003–.004.

[211] *Id.* § 423.003(a).

[212] TEX. PENAL CODE ANN. § 6.03(a).

[213] TEX. GOV'T CODE ANN. § 423.001.

[214] *See id.* §§ 423.002, .003(b), .006(a)(2)(A).

[215] *See id.* § 423.002.

[216] *See* Farber, *supra* note 16, at 397.

[217] *See* 14 C.F.R. § 107.51(b) (2016).

the rule's release and is cognizant of them.[218] Therefore, it seems unlikely it would grant a waiver of the height restriction if sought for the purpose of avoiding privacy laws.[219] But even if a waiver is granted, UAS would no longer provide the advantage of improved results gathered from lower airspace.[220]

Though it is tenuous, owners of window tracts can make a creative argument that the UAS are "used" to capture images (in the form of sound waves) of the minerals underlying the window tract if monitoring drones are used in connection with a large-scale seismic operation. To succeed, a court would have to accept an argument that "used to capture" may be broadly interpreted to include any involvement of UAS in connection with the capture of seismic data. Proving intent to capture data from the window tract would also be difficult, as the exploration company would have a strong argument that it only intended to capture data from the permitted tract and that any capture from the window tract was purely incidental. But a counterargument that placement of receivers very close to or directly on the border of the window tract evidences an ulterior motive would likely play well with a jury, especially if the action is brought in a district where many of the residents are mineral owners.

Further, in Texas, a $10,000 civil penalty can be recovered for any violation of section 423.004, the publication violation.[221] Liability exposure therefore doubles if an exploration company "possesses, discloses, displays, distributes, or otherwise uses" an image captured in violation of section 423.003.[222] Note also that mere possession or disclosure constitutes a violation, in contrast to the "publicity" requirement under the Restatement approach.[223] Thus, disclosure pursuant to a confidentiality agreement may still constitute a violation if the images obtained were captured in violation of section 423.003.[224]

In light of the potential cost, operators should simply take advantage of the available statutory defenses to avoid the possibil-

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[218] Operation and Certification of Small Unmanned Aircraft Systems (Small UAS Rule), 81 Fed. Reg. 42,064, 42,191–92 (June 28, 2016).

[219] *See id.*

[220] *See* Antunes, *supra* note 110.

[221] TEX. GOV'T CODE ANN. § 423.006(a)(2)(B).

[222] *Id.* §§ 423.004(a), .006(a)(2)(B). Actual damages are also recoverable upon a showing of malice, but this would likely be exceedingly difficult to establish. *Id.* § 423.006(a)(3).

[223] *Compare id.* § 423.004(a)(2), *with* RESTATEMENT (SECOND) OF TORTS § 652D cmt. a (AM. LAW INST. 1977).

[224] *See* TEX. GOV'T CODE ANN. § 423.004(a).

ity of costly litigation altogether.[225] Section 423.003(c) provides a defense where the image was destroyed: (1) as soon as it became known the image was captured; and (2) without disclosing, displaying, or distributing it to any third party.[226] If exploration companies adhere to these requirements as a matter of prudent risk management, then the deterrent effect of the statute provides an effective solution to the shortcomings of geophysical trespass caselaw and common law privacy torts.

Only time will tell whether this result occurs. If it does, the other major oil and gas production states should follow the lead of Texas and pass similar laws.

VI. CONCLUSION

UAS offer incredible opportunities to improve efficiency and safety in exploration operations moving forward. However, the current state of the common law is largely deficient to protect the property and privacy interests of mineral and surface owners from the issues that can arise when drones are used in connection with geophysical exploration operations. As this use continues to expand, both property owners and exploration companies should make it a point of emphasis during negotiations that language is included to address UAS. Clear and concise terms in an agreement will benefit both parties by harmonizing expectations and avoiding the unpredictability of having these issues decided by the courts.

Further, although the common law privacy tort actions provided in the Restatement will unlikely suffice to protect landowners, the Texas legislature has provided an example of a working framework to apply the torts of intrusion upon seclusion and publicity of private life to a context involving drones. Moving forward, if the Texas statute proves effective in protecting property owners by deterring abuses by exploration companies, other major oil and gas production states should follow Texas's lead. Under this two-prong approach—careful contract drafting and state privacy legislation—exploration companies and property owners alike can reduce many of the problems that may be caused by UAS while still enjoying their benefits.

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[225] *See id.* § 423.003(c).

[226] *Id.*