

**United States Court of Appeals  
for the Federal Circuit**

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**THALES VISIONIX INC.,**  
*Plaintiff-Appellant*

v.

**UNITED STATES,**  
*Defendant-Appellee*

**ELBIT SYSTEMS OF AMERICA, LLC,**  
*Third Party Defendant-Appellee*

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2015-5150

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Appeal from the United States Court of Federal Claims in No. 1:14-cv-00513-TCW, Judge Thomas C. Wheeler.

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Decided: March 8, 2017

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Before MOORE, WALLACH, and STOLL, *Circuit Judges*.

MOORE, *Circuit Judge*.

Thales Visionix, Inc. (“TVI”) appeals from the U.S. Court of Federal Claims (“Claims Court”) judgment on the pleadings holding that claims 1–5, 11–13, 20, 22–26, 32–34, and 41 of U.S. Patent No. 6,474,159 (“159 patent”) are directed to patent-ineligible subject matter. *Thales Visionix, Inc. v. United States*, 122 Fed. Cl. 245, 257 (2015). We *reverse* the Claims Court’s determination for all claims and *remand* for further proceedings.

#### BACKGROUND

The ’159 patent discloses an inertial tracking system for tracking the motion of an object relative to a moving reference frame. ’159 patent at 1:54–56. Inertial sensors, such as accelerometers and gyroscopes, measure the specific forces associated with changes in a sensor’s position and orientation relative to a known starting position. Such sensors are used in a wide variety of applications, including aircraft navigation and virtual reality simulations. When mounted on a moving object, inertial sensors can calculate the position, orientation, and velocity of the object in 3-dimensional space, based on a specified starting point, without the need for any other external information. Because small errors in the measurement of

acceleration and angular velocity translate to large errors in position over time, inertial systems generally include at least one other type of sensor, such as an optical or magnetic sensor, to intermittently correct these errors that compound over time.

The patent disclosure recognized that conventional solutions for tracking inertial motion of an object on a moving platform were flawed because both object- and platform-based inertial sensors measured motion relative to earth, and the error-correcting sensors on the tracked object measured position relative to the moving platform. *Id.* at 1:23–42. Attempting to fuse this data produced inconsistent position information when the moving platform accelerated or turned. *Id.*

The inertial sensors disclosed in the '159 patent do not use the conventional approach of measuring inertial changes with respect to the earth. *Id.* at 7:12–23. Instead, the platform (e.g., vehicle) inertial sensors directly measure the gravitational field in the platform frame. *Id.* at 7:12–49, fig. 3D. The object (e.g., helmet) inertial sensors then calculate position information relative to the frame of the moving platform. *Id.* at 7:41–67, 8:1–17, fig. 3D. By changing the reference frame, one can track the position and orientation of the object within the moving platform without input from a vehicle attitude reference system or calculating orientation or position of the moving platform itself. *Id.* at 8:34–41.

There are multiple advantages of the disclosed system over the prior art. First, it increases the accuracy with which inertial sensors measure the tracked object on the moving frame. *Id.* at 11:31–34. When the moving platform accelerates or turns, the inertial sensor on the platform directly measures the gravitational effect in the moving reference frame and the system therefore requires fewer measured inputs (and fewer points of potential error) to determine the position and orientation of the

tracked object. *Id.* at 8:34–37. Second, the disclosed system can operate independently, without requiring other hardware on the moving platform that determine the orientation or position of the moving platform itself. *Id.* at 8:34–41. Third, because the whole system is installed on the inside of the moving platform, installation is also simpler than previous inertial systems. *Id.* at 7:5–10.

Claims 1 and 22, the only independent claims,<sup>1</sup> recite:

1. A system for tracking the motion of an object relative to a moving reference frame, comprising:

a first inertial sensor mounted on the tracked object;

a second inertial sensor mounted on the moving reference frame; and

an element adapted to receive signals from said first and second inertial sensors and configured to determine an orientation of the object relative to the moving reference frame based on the signals received from the first and second inertial sensors.

22. A method comprising determining an orientation of an object relative to a moving reference frame based on signals from two inertial sensors mounted respectively on the object and on the moving reference frame.

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<sup>1</sup> The parties do not agree to any representative claims, and TVI argues that the Claims Court erred by failing to separately consider the eligibility of dependent claims. Because we hold the independent claims patent eligible, we do not reach this issue.

TVI sued the government and asserted the helmet-mounted display system (“HMDS”) in the F-35 Joint Strike Fighter infringes claims 1–5, 11–13, 20, 22–26, 32–34, and 41 of the ’159 patent. Elbit Systems of America (“Elbit”), the government subcontractor that produces the HMDS, joined the case as a third-party defendant. The government and Elbit moved for judgment on the pleadings, arguing all asserted claims disclosed patent-ineligible subject matter under 35 U.S.C. § 101 because they claim a law of nature.

The Claims Court granted the defendants’ motion for judgment on the pleadings and held all claims directed to patent-ineligible subject matter under 35 U.S.C. § 101. It found the claims (1) are directed to the abstract idea of using laws of nature governing motion to track two objects, and (2) provide no inventive concept beyond the abstract idea. TVI appeals. We have jurisdiction under 28 U.S.C. § 1295(a)(3).

#### DISCUSSION

We review a decision from the Claims Court granting judgment on the pleadings de novo. *Cary v. United States*, 552 F.3d 1373, 1376 (Fed. Cir. 2009). We also review a determination that claims are not directed to patent-eligible subject matter de novo. *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1334 (Fed. Cir. 2016).

Section 101 provides that anyone who “invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof” may obtain a patent. 35 U.S.C. § 101. The Supreme Court has repeatedly emphasized that patent protection should not extend to claims that monopolize “the basic tools of scientific and technological work.” *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972); *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 71 (2012); *Alice Corp. Pty. v. CLS Bank Int’l*, 134 S. Ct. 2347, 2354 (2014). Accordingly, laws of nature, natu-

ral phenomena, and abstract ideas are not patent-eligible subject matter. *Alice*, 134 S. Ct. at 2354.

The Supreme Court’s two-part *Alice* framework guides courts in distinguishing between patent claims that impermissibly claim the “building blocks of human ingenuity” and those that “integrate the building blocks into something more.” *Id.* (internal quotations omitted). First, we “determine whether the claims at issue are directed to a patent-ineligible concept.” *Id.* at 2355. If so, we “examine the elements of the claim to determine whether it contains an ‘inventive concept’ sufficient to ‘transform’ the claimed abstract idea into a patent-eligible application.” *Id.* at 2357 (quoting *Mayo*, 566 U.S. at 72, 79).

We begin our analysis at *Alice* step one: “whether the claims at issue are directed to a patent-ineligible concept.” *Id.* at 2355. While the two steps of the *Alice* framework are related, the “Supreme Court’s formulation makes clear that the first-stage filter is a meaningful one, sometimes ending the § 101 inquiry.” *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1353 (Fed. Cir. 2016).

The Supreme Court “has not established a definitive rule to determine what constitutes an ‘abstract idea’” for the purposes of step one. *Enfish*, 822 F.3d at 1334 (citing *Alice*, 134 S. Ct at 2357). We have held claims ineligible as directed to an abstract idea when they merely collect electronic information, display information, or embody mental processes that could be performed by humans. *Elec. Power Grp.*, 830 F.3d at 1353–54 (collecting cases). At the same time, “all inventions at some level embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas.” *Mayo*, 566 U.S. at 71. We must therefore ensure at step one that we articulate what the claims are directed to with enough specificity to ensure the step one inquiry is meaningful. *Alice*, 134

S. Ct. at 2354 (“[W]e tread carefully in construing this exclusionary principle lest it swallow all of patent law.”).

A number of cases are instructive as to the step one analysis. In *Rapid Litigation Management Ltd. v. CellzDirect, Inc.*, we evaluated claims for an improved process of preserving a type of liver cell by taking previously frozen and thawed cells, separating viable cells from non-viable ones, and recovering and refreezing the viable cells. 827 F.3d 1042, 1045 (Fed. Cir. 2016). We held the claims patent-eligible under step one of *Alice* because they were directed to “a new and useful laboratory technique for preserving [liver cells].” *Id.* at 1048. While “the inventors certainly discovered the cells’ ability to survive multiple freeze-thaw cycles,” they did not claim the natural law itself, but a particular application of the “natural discovery to create a new and improved way of preserving [liver] cells for later use.” *Id.*

In *Enfish LLC v. Microsoft Corp.*, we held claims directed to a self-referential logical model for a computer database patent-eligible under step one of *Alice*. 822 F.3d at 1330. The disclosed technique enabled faster searching and more effective storage of data than previous methods. *Id.* at 1333. We found the claims directed to “a specific improvement to the way computers operate, embodied in the self-referential table.” *Id.* at 1336. We explained that the claims are “not simply directed to *any* form of storing tabular data, but instead are specifically directed to a *self-referential* table for a computer database” that functions differently than conventional databases. *Id.* at 1337.

In *Diamond v. Diehr*, the Supreme Court confirmed the eligibility of patent claims despite the inclusion of a mathematical formula in a claimed method for molding raw, uncured rubber into cured rubber products. 450 U.S. 175, 177 (1981). The claimed method used the well-known Arrhenius equation to calculate the optimal cure time using, among other variables, the internal tempera-

ture of the mold. *Id.* at 177 n.2. The invention improved upon prior art molding methods by constantly measuring the actual temperature inside the mold, recalculating the ideal cure time, and automatically opening the press when the ideal cure time equaled the actual time elapsed. *Id.* at 178–79.

The Supreme Court recognized that a mathematical formula like the Arrhenius equation is not itself patent-eligible subject matter, even if limited to a particular technological environment or accompanied by “insignificant post-solution activity.” *Id.* at 191–92; see *Parker v. Flook*, 437 U.S. 584, 585–86, 594–95 (1978). Nonetheless, the Supreme Court held that the claims in *Diehr* covered patent-eligible subject matter because they “describe[d] a process of curing rubber beginning with the loading of the mold and ending with the opening of the press and the production of a synthetic rubber product that has been perfectly cured—a result heretofore unknown in the art.” *Diehr*, 450 U.S. at 193 n.15. It explained that claims are patent eligible under § 101 “when a claim containing a mathematical formula implements or applies that formula in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect.” *Id.* at 192. In terms of the modern day *Alice* test, the *Diehr* claims were directed to an improvement in the rubber curing process, not a mathematical formula.<sup>2</sup>

For the purpose of evaluating patent eligibility, the ’159 patent claims are nearly indistinguishable from the claims at issue in *Diehr*. Claim 1, the independent system claim, requires: (1) a first inertial sensor mounted on

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<sup>2</sup> *Diehr* preceded the evolution of the Supreme Court’s two-step framework and therefore did not separate its analysis into the two *Alice* steps. We do not hold that *Diehr* is instructive precedent only for *Alice* step one.



the tracked object; (2) a second inertial sensor mounted on the moving platform; and (3) an element that uses the data from the two inertial sensors to calculate the orientation of the tracked object relative to the moving platform, as disclosed in the specification. Claim 22, the independent method claim, requires: (1) a first inertial sensor on a tracked object; (2) a second inertial sensor on the moving platform; and (3) the determination of orientation of the tracked object “based on” the signals from the two inertial sensors, as disclosed in the specification. The navigation equations in the ’159 patent are derived from this particular arrangement of sensors. ’159 patent at 7:41–8:55. While the claims utilize mathematical equations to determine the orientation of the object relative to the moving reference frame, the equations—dictated by the placement of the inertial sensors and application of laws of physics—serve only to tabulate the position and orientation information in this configuration. This arrangement is analogous to the claims in *Diehr*, which required the temperature measurement “at a location closely adjacent to the mold cavity in the press during molding.” *Diehr*, 450 U.S. at 179 n.5. Just as the claims in *Diehr* reduced the likelihood that the rubber molding process would result in “overcuring” or “undercuring,” *id.* at 187, the claims here result in a system that reduces errors in an inertial system that tracks an object on a moving platform.

The ’159 patent claims provide a method that eliminates many “complications” inherent in previous solutions for determining position and orientation of an object on a moving platform. ’159 patent at 5:62–6:32. Because the motion of a moving platform like a plane “is more dynamic and unpredictable than the earth’s rotation,” a traditional system (which measured inertial data with respect to the earth) had difficulty accurately calculating inertial data of an object on a moving platform. *Id.* at 5:60–6:16. Though the unconventional utilization of inertial sensors

as specified by the '159 patent “may seem somewhat strange” to those within the field, *id.* at 7:19–21, this combination of sensor placement and calculation based on a different reference frame mitigates errors by eliminating inertial calculations with respect to the earth. *Id.* at 7:41–8:41. The resulting system works with any type of moving platform and is simpler to install than conventional systems. *Id.* at 7:5–8. The system is also beneficially self-contained: it requires no external information about the orientation or position of the platform. *Id.* at 8:34–41, 11:34–38.

These claims are not merely directed to the abstract idea of using “mathematical equations for determining the relative position of a moving object to a moving reference frame,” as the Claims Court found. *Thales*, 122 Fed. Cl. at 252. Rather, the claims are directed to systems and methods that use inertial sensors in a non-conventional manner to reduce errors in measuring the relative position and orientation of a moving object on a moving reference frame. At step one, “it is not enough to merely identify a patent-ineligible concept underlying the claim; we must determine whether that patent-ineligible concept is what the claim is ‘directed to.’” *Rapid Litig.*, 827 F.3d at 1050. Just as a natural law can be utilized to create an improved laboratory technique for preserving liver cells, *id.* at 1048, so can the application of physics create an improved technique for measuring movement of an object on a moving platform. Just as claims directed to a new and useful technique for defining a database that runs on general-purpose computer equipment are patent eligible, *Enfish*, 822 F.3d at 1337–38, so too are claims directed to a new and useful technique for using sensors to more efficiently track an object on a moving platform. That a mathematical equation is required to complete the claimed method and system does not doom the claims to abstraction.

We hold that the '159 patent claims at issue in this appeal are not directed to an abstract idea. The claims specify a particular configuration of inertial sensors and a particular method of using the raw data from the sensors in order to more accurately calculate the position and orientation of an object on a moving platform. The mathematical equations are a consequence of the arrangement of the sensors and the unconventional choice of reference frame in order to calculate position and orientation. Far from claiming the equations themselves, the claims seek to protect only the application of physics to the unconventional configuration of sensors as disclosed. As such, these claims are not directed to an abstract idea and thus the claims survive *Alice* step one.

Because we find the claims are not directed to an abstract idea, we need not proceed to step two. *Alice*, 134 S. Ct. at 2355; *Enfish*, 822 F.3d at 1339. The claims are patent eligible under 35 U.S.C. § 101.

#### CONCLUSION

For the foregoing reasons, we reverse the Claims Court's determination that the '159 patent claims patent-ineligible subject matter and remand for further proceedings.

**REVERSED AND REMANDED**