

9IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Shelton
U.S. Patent No.: 11,703,602 Attorney Docket No: 013639.00051
Issue Date: July 18, 2023
Appl. Serial No.: 17/845,115
Filing Date: Jun. 21, 2022
Title: TRAFFIC RADAR SYSTEM WITH PATROL VEHICLE
SPEED DETECTION

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 11,703,602 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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EXHIBITS

ACI-1001	U.S. Patent No. 11,703,602 to Shelton (“the ’602 Patent”)
ACI-1002	Prosecution History of the ’602 Patent
ACI-1003	Declaration of Dr. Brian Anthony
ACI-1004	U.S. Patent Pub. No. 2004/0257268 (“Aker”)
ACI-1005	United Kingdom Patent Pub. No. 2,334,700 (“Thomas”)
ACI-1006	U.S. Patent Pub. No. 2005/0146458 (“Carmichael”)
ACI-1007	U.S. Patent No. 5,691,724 (“Aker ’724”)
ACI-1008	U.S. Patent No. 6,023,236 (“Shelton”)
ACI-1009	U.S. Patent No. 5,528,246 (“Henderson”)
ACI-1010	U.S. Patent Pub. No. 2005/0062642 (“Aker ’642”)
ACI-1011	Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (USPTO June 21, 2022) (“Director’s Guidance”)
ACI-1012	Combined Civil and Criminal Federal Court Management Statistics (Dec. 31, 2023), United States Courts (uscourts.gov), https://www.uscourts.gov/sites/default/files/fcms_na_distprofile1231.2023_0.pdf
ACI-1013	Stipulation by Applied Concepts Inc.
ACI-1014	U.S. Patent No. 11,194,039 to Shelton (“the ’039 Patent”)
ACI-1015	U.S. Patent Pub. No. 2019/0107619 (“the ’039 Publication”)
ACI-1016	U.S. Patent No. 5,898,400 (“Jones”)

CLAIM LISTING

Limitation	Claim Language
[1.0]	A traffic radar system comprising:
[1.1]	a radar transceiver configured to transmit and receive radar beams in a front zone corresponding to an area in front of a patrol vehicle or in a rear zone corresponding to an area behind the patrol vehicle and to generate an electronic signal corresponding to the received radar beam;
[1.2]	a speed determining element configured to determine and output a speed of the patrol vehicle and not receive signals or data from the patrol vehicle; and
[1.3]	a processing element configured to
[1.4]	receive a plurality of digital data samples derived from the electronic signal,
[1.5]	receive the speed of the patrol vehicle from the speed determining element,
[1.6]	perform a time domain to frequency domain conversion on the digital data samples creating a plurality of frequency bins, each frequency bin associated with a frequency bin number, having a relative magnitude value, and corresponding to a speed of a vehicle,
[1.7]	convert the speed of the patrol vehicle to a frequency bin number,
[1.8]	form a patrol vehicle speed window that includes a range of frequency bin numbers having the frequency bin number of the converted patrol vehicle speed as a center of the range,
[1.9]	determine at least one group of successive frequency bin numbers outside of the patrol vehicle speed window whose relative magnitude is greater than a spike threshold value,
[1.10]	convert one frequency bin number in each group to the relative speed of one target vehicle, and
[1.11]	convert the relative speed of the target vehicle to an absolute speed using the speed of the patrol vehicle.

Limitation	Claim Language
[2.0]	The traffic radar system of claim 1, wherein the processing element is further configured to perform one of the following depending the directions of travel of the patrol vehicle and the target vehicle:
[2.1]	add the relative speed of the target vehicle to the speed of the patrol vehicle to determine the absolute speed of the target vehicle,
[2.2]	subtract the relative speed of the target vehicle from the speed of the patrol vehicle to determine the absolute speed of the target vehicle, and
[2.3]	subtract the speed of the patrol vehicle from the relative speed of the target vehicle to determine the absolute speed of the target vehicle.
[3.0]	The traffic radar system of claim 1, wherein the processing element is further configured to determine whether the patrol vehicle is moving or stationary and convert the relative speed of the target vehicle to the absolute speed using the speed of the patrol vehicle only when the patrol vehicle is moving.
[4.0]	The traffic radar system of claim 1, wherein the speed determining element outputs the patrol vehicle speed in a stream of messages and the processing element is further configured to determine that the patrol vehicle is moving when the patrol vehicle speed is greater than a first threshold value for a predetermined number of successive messages.
[5.0]	The traffic radar system of claim 1, wherein the speed determining element outputs the patrol vehicle speed in a stream of messages and the processing element is further configured to determine that the patrol vehicle is stationary when the patrol vehicle speed is less than a second threshold value for a predetermined number of successive messages.

Limitation	Claim Language
[6.0]	The traffic radar system of claim 1, wherein the speed determining element is further configured to receive and process radio frequency signals from a global navigation satellite system.
[7.0]	The traffic radar system of claim 1, further comprising a display configured to display a plurality of speeds, and the processing element is further configured to control the display to display the speed of the patrol vehicle and the absolute speed of the target vehicle.
[8.0]	The traffic radar system of claim 1, further comprising an analog to digital converter configured to receive the electronic signal and output the digital data samples.
[9.0]	A traffic radar system comprising:
[9.1]	a radar transceiver configured to transmit and receive radar beams in a front zone corresponding to an area in front of a patrol vehicle or in a rear zone corresponding to an area behind the patrol vehicle and to generate an electronic signal corresponding to the received radar beam;
[9.2]	a speed determining element configured to receive and process radio frequency signals from a global navigation satellite system to determine and output a speed of the patrol vehicle; and
[9.3]	a processing element configured to
[9.4]	receive a plurality of digital data samples derived from the electronic signal,
[9.5]	receive the speed of the patrol vehicle from the speed determining element,
[9.6]	perform a time domain to frequency domain conversion on the digital data samples creating a plurality of frequency bins, each frequency bin associated with a frequency bin number, having a

Limitation	Claim Language
	relative magnitude value, and corresponding to a speed of a vehicle,
[9.7]	convert the speed of the patrol vehicle to a frequency bin number,
[9.8]	form a patrol vehicle speed window that includes a range of frequency bin numbers having the frequency bin number of the converted patrol vehicle speed as a center of the range,
[9.9]	determine at least one group of successive frequency bin numbers outside of the patrol vehicle speed window whose relative magnitude is greater than a spike threshold value,
[9.10]	convert one frequency bin number in each group to the relative speed of one target vehicle, and
[9.11]	convert the relative speed of the target vehicle to an absolute speed using the speed of the patrol vehicle.
[10.0]	The traffic radar system of claim 9, wherein the processing element is further configured to perform one of the following depending the directions of travel of the patrol vehicle and the target vehicle:
[10.1]	add the relative speed of the target vehicle to the speed of the patrol vehicle to determine the absolute speed of the target vehicle,
[10.2]	subtract the relative speed of the target vehicle from the speed of the patrol vehicle to determine the absolute speed of the target vehicle, and
[10.3]	subtract the speed of the patrol vehicle from the relative speed of the target vehicle to determine the absolute speed of the target vehicle.
[11.0]	The traffic radar system of claim 9, wherein the processing element is further configured to determine whether the patrol vehicle is moving or stationary and convert the relative speed of the target vehicle to the absolute speed using the speed of the patrol vehicle only when the patrol vehicle is moving.

Limitation	Claim Language
[12.0]	The traffic radar system of claim 9, wherein the speed determining element outputs the patrol vehicle speed in a stream of messages and the processing element is further configured to
[12.1]	determine that the patrol vehicle is moving when the patrol vehicle speed is greater than a first threshold value for a predetermined number of successive messages, and
[12.2]	determine that the patrol vehicle is stationary when the patrol vehicle speed is less than a second threshold value for a predetermined number of successive messages.
[13.0]	The traffic radar system of claim 12, wherein the processing element is further configured to set a mode of speed detection to moving when the processing element determines that the patrol vehicle is moving or to stationary when the processing element determines that the patrol vehicle is stationary.
[14.0]	The traffic radar system of claim 9, further comprising a display configured to display a plurality of speeds, and the processing element is further configured to control the display to display the speed of the patrol vehicle and the absolute speed of the target vehicle.
[15.0]	The traffic radar system of claim 9, further comprising an analog to digital converter configured to receive the electronic signal and output the digital data samples.

Applied Concepts Inc. (“Petitioner” or “Applied Concepts”) petitions for *Inter Partes* Review (“IPR”) of claims 1-15 (“the Challenged Claims”) of U.S. Patent 11,703,602 (“the ’602 Patent”). Compelling evidence presented in this Petition demonstrates at least a reasonable likelihood of prevailing with respect to at least one Challenged Claim, and Petitioner respectfully requests institution of IPR and cancellation of all Challenged Claims as unpatentable.

I. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104

A. Standing

Petitioner certifies that the ’602 Patent is available for IPR. Petitioner is not barred or estopped from requesting this review challenging the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

Petitioner requests IPR of the Challenged Claims on the grounds set forth in the table below. Additional explanation and support for each ground is set forth in the expert Declaration of Brian Anthony, Ph.D. (ACI-1003), referenced throughout this Petition.

Ground	Challenged Claims	Basis for Rejection
1A	1-3, 6-11, 14, 15	Obviousness (§103) over Aker, Aker '724, and Thomas
1B	3-5, 11-13	Obviousness (§103) over Aker, Aker '724, Thomas, and Carmichael
2A	1-3, 6-11, 14, 15	Obviousness (§103) over Shelton, Henderson, and Thomas
2B	3-5, 11-13	Obviousness (§103) over Shelton, Henderson, Thomas, and Carmichael
3	1-15	Obviousness (§103) over '039 Publication and Jones

The '602 Patent claims priority to an application filed October 9, 2017, which Petitioner treats as the earliest effective filing date (“Critical Date”) of the Challenged Claims for purposes of Grounds 1A, 1B, 2A and 2B of this IPR.¹ For Ground 3, Petition treats the date of filing of the claims as the earliest effective priority date. Each of the prior art references applied in the grounds listed above qualifies as prior art to the '602 Patent on at least the bases shown below:

Reference	Filed	Published	35 U.S.C. §102 Prior Art Basis
Aker	Nov. 10, 2003	Dec. 23, 2004	102(a)(1), 102(a)(2)
Thomas	Jan. 26, 1998	Sep. 1, 1999	102(a)(1)), 102(a)(2)

¹ Petitioner does not concede that the '602 Patent is entitled to priority of the Critical Date and reserves the right to challenge the validity of that priority claim in this or other proceedings.

Reference	Filed	Published	35 U.S.C. §102 Prior Art Basis
Carmichael	Jan. 7, 2004	Jul. 7, 2005	102(a)(1), 102(a)(2)
Aker '724	Aug. 9, 1996	Nov. 25, 1997	102(a)(1), 102(a)(2)
Shelton	Nov. 30, 1998	Feb. 8, 2000	102(a)(1), 102(a)(2)
Henderson	Jun. 30, 1994	Jun. 18, 1996	102(a)(1), 102(a)(2)
Jones	Sep. 16, 1997	Apr. 27, 1999	102(a)(1), 102(a)(2)

None of the references above is cited on the face of the '602 Patent, and none of those references were considered during prosecution of the '602 Patent.

II. SUMMARY OF THE '602 PATENT

A. Brief Description

The '602 Patent, titled “Traffic Radar System with Patrol Vehicle Speed Detection,” issued on July 18, 2023 from an application filed on June 21, 2022. ACI-1001, Face. The patent claims priority to U.S. Patent No. 11,579,314 as a continuation, to U.S. Patent No. 11,194,039 (the '039 Patent) as a continuation-in-part, and to three provisional applications, the earliest of which was filed October 9, 2017. *Id.*

The '602 Patent describes a “traffic radar system” for use in a vehicle including “a first radar transceiver” directed towards the front of the vehicle, “a second radar transceiver” directed towards the rear of the vehicle, “a speed determining element” (*e.g.*, a speedometer), and “a processing element.” *Id.*, Abstract. The processing element analyzes digitized radio signals from the radar

transceivers to identify targets and determine their speed relative to the vehicle, and then calculates the absolute speed of the target based on the measured speed of the vehicle from the speed determining element. *See id.* The processing element utilizes a well-known signal processing technique (a “fast Fourier transform” or “FFT”) to process the digitally-sampled radar return signal and “produce[] a plurality of frequency bins” each “having a relative magnitude value” representing the strength of the frequency associated with the bin in the received radar signal. *Id.*, 8:56-60. The use of the FFT algorithm in traffic radar systems was well-known in the art decades prior to the ’602 Patent. *See, e.g.*, ACI-1004, [0091]; ACI-1006, [0059]; ACI-1007, 22:39-23:3; ACI-1009, 4:42-64 (each describing performing an FFT on a digitally-sampled radar signal to produce frequency bins); ACI-1003, [15]-[17].

B. Level of Ordinary Skill in the Art

A person of ordinary skill in the art relating to, and at the time of, the invention of the ’602 Patent (“POSITA”) would have been a person with a working knowledge of Doppler radar systems. The person would have had a Bachelor of Science degree in an academic discipline emphasizing electrical, mechanical, instrumentation engineering or other disciplines related measurement science, in combination with specific training or at least one to two years of related work experience with Doppler radar systems. ACI-1003, [18]-[20]. Alternatively, the

person could have also had a Master of Science degree in electrical engineering with less than a year of related work experience in the same discipline. *Id.*

III. CLAIM CONSTRUCTION UNDER 37 C.F.R. §§ 42.104(B)(3)

All claim terms should be construed according to the *Phillips* standard.

Phillips v. AWH Corp., 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. §42.100.

Petitioner submits that, based on the evidence presented herein and the prior art's description of the claimed elements being similar to that of the '602 Patent specification, no formal claim constructions, other than those listed below, are necessary in this proceeding because "claim terms need only be construed to the extent necessary to resolve the controversy." *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011); ACI-1003, [21]-[22].²

² Petitioner does not concede that the features of the Challenged Claims satisfy all statutory requirements such as 35 U.S.C. § 112. As this is an IPR petition, the present Petition presents only prior art-based grounds. Petitioner reserves the right to present or maintain arguments in other proceedings concerning grounds that cannot be raised in IPR (*e.g.*, § 112, § 101, etc.). Further, Petitioner does not concede the definiteness of this or any limitation based on the application of the prior art in the present IPR.

A. “a radar transceiver configured to transmit and receive radar beams in a front zone corresponding to an area in front of a patrol vehicle or in a rear zone corresponding to an area behind the patrol vehicle”

Petitioner proposes two alternative constructions for this claim term.

Grounds 1A, 1B, 2A, and 2B apply the First Interpretation, and Ground 3 applies the Second Interpretation.

1. First Interpretation (Grounds 1A, 1B, 2A, 2B): “a radar transceiver configured to transmit and receive radar beams [either] in a front zone ...or in a rear zone [but not both]”

Under this interpretation, the claimed radar transceiver is configured to transmit and receive radar beams either in a front zone or in a rear zone, but not both. The specification of the '602 Patent supports such an interpretation by describing a “front radar transceiver” that “may be mounted or installed on the forward portion of the patrol vehicle” and that transmits radar beams “in front of the patrol vehicle,” and a “rear radar transceiver” that “may be mounted or installed on the rear portion of the patrol vehicle” and that transmits radar beams “in the rear of the patrol vehicle.” ACI-1001, 4:29-5:24; ACI-1003, [24].

2. Second Interpretation (Ground 3): “a radar transceiver configured to transmit and receive radar beams [both] in a front zone ...or in a rear zone corresponding to an area behind the patrol vehicle”

Under this interpretation, likely to be advanced by Patent Owner in the co-pending litigation, the claimed radar transceiver is configured to transmit and

receive radar beams both in a front zone or in a rear zone, which requires the radar transceiver to be directional. As discussed in greater detail below (*see* Section IV.E.1 *supra*), if the claim is interpreted in this manner, the '602 Patent is not entitled to its claimed priority because an element of its priority chain (the '039 Patent) fails to provide written description support for this claim feature. ACI-1003, [25].

IV. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1A: Claims 1-3, 6-11, 14, and 15 are obvious over Aker in view of Aker '724 and Thomas

1. Overview of Aker

Aker discloses a “traffic radar” system “with direction sensing capability” in which reflected radar signals “are digitized and the samples are processed by a digital signal processor programmed to find one or more selected target speeds.” ACI-1004, Abstract, [0001], [0052]. Aker discloses that a “microwave antenna is used to transmit outgoing radar beams and receive reflected radar energy from moving and stationary objects,” and the reflected energy is used to calculate target speed. *Id.*, [0042]. Aker further discloses a “preferred two antenna embodiment” where “two antennas are located on the front and rear of the patrol car.” *Id.*, [0056], [0057].

Aker discloses that the “patrol car speed” (*i.e.*, the ground speed of the vehicle containing the radar system) “can be determined from the car's

speedometer (as opposed to processing returns from stationary objects such as the ground),” and discloses “an optional speedometer link transducer 59 provides a signal or data to the DSP from which the indicated speed on the speedometer can be determined for use in moving mode target speed calculations.” *Id.*, [0051].

Aker further discloses that the operation of its traffic radar system is further detailed in the Aker ’724 patent, which Aker incorporates by reference. *See, e.g.*, ACI-1004, [0004] (“The Stalker Dual radar is fully described in U.S. Pat. No. 5,691,724 which has an effective filing date of Feb. 10, 1995, the full contents of which are hereby incorporated by reference.”), [0052], [0053], [0054], [0084], [0094], [0110].

2. Overview of Aker ’724

Similar to Aker, Aker ’724 discloses a “police radar utilizing digital data transmission from the antenna unit to a separately housed counting and display unit.” ACI-1007, Abstract. Aker ’724 provides additional detail on aspects of the processing of samples of the received radar energy using fast Fourier transforms by the digital signal processor (DSP). ACI-1004, [0053], [0054]; ACI-1007, 22:1-6, 23:41-63.

3. Overview of Thomas

Thomas relates to a device “for a vehicle engine which is designed to restrict the vehicle speed automatically.” ACI-1005, Abstract. One component of the

device is a “controller 10” that “includes a receiver 12 to receive a signal from...global positioning satellites.” *Id.*, 4:33-5:3. The controller 10 “calculate[s]” a “current-vehicle-speed signal...from GPS (global positioning data).” *Id.*, 2:8-10; *see also* 7:7-8:1 (“The information available from the GPS system can be used to calculate speed, therefore obviating the need for a separate speed sensor 22 input.”). In Thomas’s system, the controller 10 outputs the “current-vehicle-speed signal” to a comparator which compares it to a speed limit signal. *Id.*, 4:33-5:16.

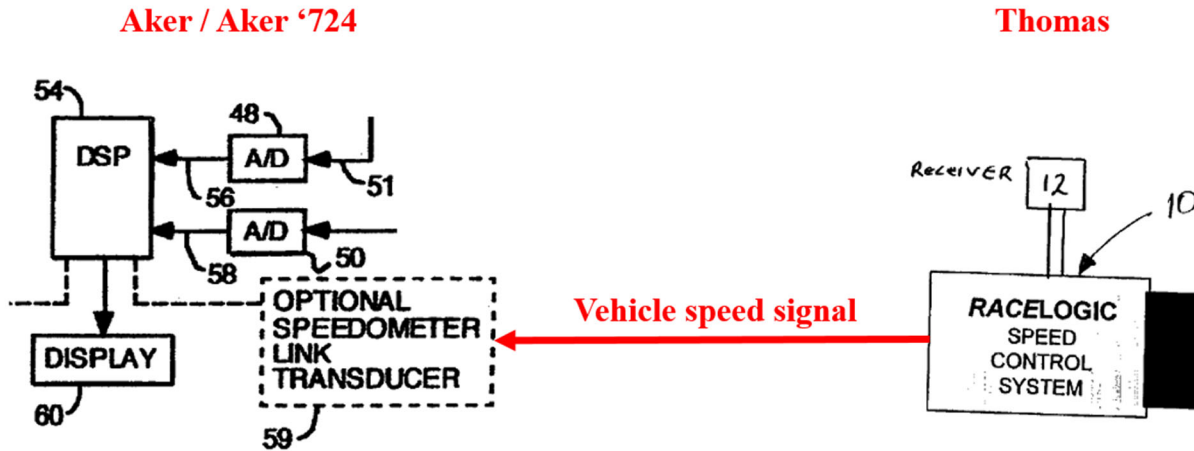
4. The combination of Aker, Aker ’724, and Thomas

In the combination, the traffic radar system of Aker is further detailed in the Aker ’724 patent, which Aker incorporates by reference. *See, e.g.*, ACI-1004, [0004] (“The Stalker Dual radar is fully described in U.S. Pat. No. 5,691,724 which has an effective filing date of Feb. 10, 1995, the full contents of which are hereby incorporated by reference.”), [0052], [0053], [0054], [0084], [0094], [0110]; ACI-1003, [31].

In addition, in the combination, the traffic radar system disclosed in Aker and Aker ’724 is modified such that the controller 10 from Thomas (including the GPS receiver 12) provides a “current-vehicle-speed signal” calculated based on the GPS data to the “speedometer link transducer 59” of the DSP in the counting display unit disclosed in Aker. ACI-1003, [32].

The following composite of FIG. 1 from Aker and FIG. 1 from Thomas

shows the asserted combination. ACI-1003, [33]:



5. Reasons to combine Aker and Aker '724

A POSITA examining Aker would have looked to Aker '724 for more information on the operation of the Aker's traffic radar system because Aker repeatedly and specifically directs the reader to Aker '724 for just such information. *See, e.g.*, ACI-1004, [0004], [0052], [0053], [0054], [0084], [0094], [0110]; ACI-1003, [35]. Even if the text of Aker '724 were not part of Aker by virtue of Aker incorporating "the full contents" Aker '724 by reference, a POSITA would nonetheless have been motivated to obtain more information when implementing the traffic radar system described in Aker, and would have been directed to Aker '724 by Aker's specific instructions. ACI-1003, [35]. The result of this combination would have been predictable because Aker and Aker '724 describe the same system, and thus this portion of the combination involves no material change to the traffic radar system of Aker. ACI-1003, [35].

6. Reasons to combine Aker/Aker '724 and Thomas

It would have been obvious to a POSITA to modify the Aker/Aker '724 radar system to receive current vehicle speed data from a GPS-enabled speedometer, as taught by Thomas. ACI-1003, [36]. Aker discloses receiving a current vehicle speed from a speedometer, without limitation to any specific type of speedometer and thus is compatible with a GPS speedometer such as that disclosed in Thomas. *See* ACI-1004, [0054], [0061], [0099]; ACI-1003, [36]. Thomas discloses a GPS speedometer, and states that “[t]he information available from the GPS system can be used to calculate speed, therefore obviating the need for a separate speed sensor input.” ACI-1005, 7:32-8:1. Thomas discloses such sensors as “largely mechanical and tend to be complex and expensive to fit to a vehicle.” *Id.*, 1:12-13. Eliminating such sensors may simplify the vehicle design, leading to a more robust final product. ACI-1003, [36]. Further, in the event of an issue with the existing speedometer in a vehicle, such as inaccuracy or mechanical issue, a POSITA would have been motivated to incorporate Thomas’ GPS speedometer, which Thomas emphasizes “can be retro-fitted to 99% of cars on the road today.” ACI-1005, 4:30-31; ACI-1003, [36].

In addition, Thomas stresses the ease with which its GPS speedometer can be incorporated into a vehicle, stating that the “controller 10 of the present invention can be connected to almost any vehicle in the world” (*id.*, 4:15-16), and

that “[t]he controller can be retro-fitted to 99% of cars on the road today” with an “[a]verage installation tak[ing] around 3 hours” (*id.*, 4:30-31). While ease of performing a combination does not necessarily represent a motivation for a POSITA to do so, these quotes make clear that incorporating Thomas’s GPS-enabled speedometer would have been accomplished by a POSITA. ACI-1003, [37].

Further, a POSITA would have found it obvious to modify Aker based on Thomas’s teachings because doing so entails the use of known solutions to improve similar systems and methods in the same way. ACI-1003, [38]. Here, “when a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). A POSITA would have recognized that applying Thomas’s teachings to augment Aker would have led to predictable results without significantly altering or hindering the functions performed by Aker’s system. ACI-1003, [38].

In fact, a POSITA would have been motivated to incorporate the well-known techniques of Thomas into Aker to achieve the predictable benefits disclosed in Thomas. ACI-1003, [39]; *see, e.g.*, ACI-1005, 1:12-13, 7:32-8:1. Indeed, a POSITA would have had a reasonable expectation of success

incorporating Thomas's teachings into Aker, because both Aker and Thomas disclose a device operating in the proposed manner. ACI-1004, [0051] ("an optional speedometer link transducer 59 provides a signal or data to the DSP from which the indicated speed on the speedometer can be determined for use in moving mode target speed calculations."); ACI-1005, 1:12-13, 2:8-10, 4:33-5:16, 7:7-8:1; ACI-1003, [39].

Accordingly, for at least these reasons, augmenting Aker's device based on the teachings of Thomas would have been routine and straightforward to a POSITA, and it would have been clear that such a combination would predictably work and provide the expected results. *Id.*; ACI-1003, [40].

7. Analysis

In the co-pending litigation, Patent Owner currently asserts claims 9-14 of the '602 Patent. Accordingly, for all Grounds in the present Petition, independent claim 9 and its dependent claims are addressed first, with non-asserted independent claim 1 and its dependents addressed subsequently.

a) Claim 9

Limitation [9.0]

To the extent the preamble is deemed limiting, the combination of Aker, Aker '724, and Thomas (hereinafter the "Aker-Thomas combination") renders it obvious. For example, in the combination, Aker discloses a "traffic radar" system

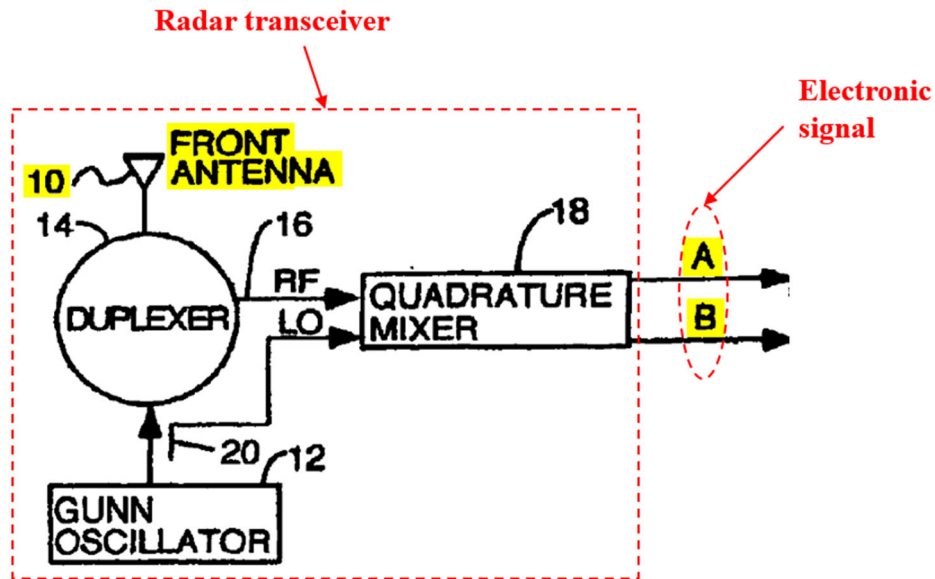
“with direction sensing capability” in which reflected radar signals “are digitized and the samples are processed by a digital signal processor programmed to find one or more selected target speeds.” ACI-1004, Abstract, [0001], [0052]; ACI-1003, [42].

Limitation [9.1]

In the combination, Aker discloses that a “***microwave antenna***” (radar transceiver) “is used to ***transmit outgoing radar beams*** and ***receive reflected radar energy*** from moving and stationary objects.” ACI-1004, [0042]. The reflected radar energy will include reflected radar beams and/or scattered reflected radar signals depending on the orientation and properties of the reflecting surface on the target object. *See id.*; ACI-1003, [43]. “Duplexer 14 is used to...guide reflected energy received by antenna 10 out on line 16 to quadrature mixer 18.” *Id.* “The function of the quadrature mixer is to mix local oscillator energy with incoming RF of reflected waves in two separate mixers in two separate channels and shift one channel 90 degrees relative to the other channel.” *Id.*, [0043]. Collectively, these channels (referred to as “channel A” and “channel B” in Aker) are a first electronic signal corresponding to the received radar beam. *See id.*, [0043]-[0046]; ACI-1003, [43].

Aker further discloses a “***preferred two antenna embodiment***” where “***two antennas are located on the front and rear of the patrol car.***” ACI-1004, [0056],

[0057]; ACI-1003, [44]. The following annotated detail of FIG. 4 of Aker shows the front antenna unit (the radar transceiver):



ACI-1004, Detail of FIG. 4 (annotated)

Under the First Interpretation of this limitation (*see* Section III.A.1 *supra*), either the front or rear antennas from Aker disclose a “radar transceiver configured to transmit and receive radar beams in a front zone...or in a rear zone.” Aker’s front antenna is configured to transmit and receive in a front zone (but not the rear), and its rear antenna is configured to transmit and receive in a rear zone (but not the front). *See, e.g.*, ACI-1004, [0056], [0057]; ACI-1003, [45]. Under the First Interpretation, the radar transceiver need only be configured to transmit and receive in either the front zone or the rear zone, so under this interpretation the limitation is satisfied by either of Aker’s antennas. *See* Section III.A.1 *supra*;

ACI-1004, [0056], [0057]; ACI-1003, [45].

Limitation [9.2]

In the combination, Thomas discloses a “controller 10” (*i.e.*, a speed determining element) that “includes a receiver 12 to ***receive a signal from...global positioning satellites.***” ACI-1005, 4:33-5:3. The controller 10 “***calculate[s]***” a “***current-vehicle-speed signal...from GPS (global positioning data).***” *Id.*, 2:8-10; *see also* 7:7-8:1 (“The information available from the GPS system can be used to calculate speed, therefore obviating the need for a separate speed sensor 22 input.”); ACI-1003, [47]. In Thomas’s system, the controller 10 outputs the “current-vehicle-speed signal” to a comparator which compares it to a speed limit signal. ACI-1005, 4:33-5:16; ACI-1003, [47].

As described in Section IV.A.4, *supra*, in the present combination, the controller 10 from Thomas (including the GPS receiver 12) provides a “current-vehicle-speed signal” calculated based on the GPS data to the “speedometer link transducer 59” of the DSP in the counting display unit (processing element, *see* [9.3] *infra*) disclosed in Aker. ACI-1004, [0051]. In addition, as described in Section IV.A.6 *supra*, a POSITA would have both found the combination obvious and been motivated perform the combination. ACI-1003, [48].

Limitation [9.3]

In the combination, Aker discloses a “***digital signal processor 54***” (a processing element), referred to throughout as a “DSP.” ACI-1004, [0048]. Aker discloses that the “function of the digital signal processor 54 is to process the digital samples from channels A and B...to determine a target speed and display it.” *Id.*, [0049]; ACI-1003, [50]. Accordingly, the Aker-Thomas combination renders obvious “a processing element” as recited in the claim.

Limitation [9.4]

In the combination, Aker discloses that the “function of the digital signal processor 54” (the processing element, *see* [9.3] *supra*) “is to ***process...digital samples from channels A and B***” (the electronic signal, *see* [9.1] *supra*). ACI-1004, [0049]. Aker discloses that “analog-to-digital converters 48 and 50...sample the analog signals” of channels A and B, and “output these samples as digital sample values on buses 56 and 58 coupled to digital signal processor 54.” *Id.*, [0048]; ACI-1003, [51].

Limitation [9.5]

In the combination, as previously discussed (*see* [9.2] *supra*), Thomas discloses a “controller 10” (the speed determining element) that “***calculate[s]***” a “***current-vehicle-speed signal...from GPS (global positioning data)***” and outputs the signal to a separate component in its system. ACI-1005, 2:8-10, 4:33-5:16; *see*

also 7:7-8:1; ACI-1003, [52].

Also in the combination, Aker discloses that a “speedometer link transducer 59 ***provides a signal or data to the DSP***” (the processing element, *see* [9.3] *supra*) ***from which the indicated speed on the speedometer can be determined*** for use in moving mode target speed calculations.” ACI-1004, [0051]; ACI-1003, [53].

As described in Section IV.A.4 *supra*, in the present combination, Aker’s DSP (the processing element, *see* [9.3] *supra*) receives the “current-vehicle-speed signal” from Thomas’s controller (the speed determining element, *see* [9.2] *supra*) via Aker’s “speedometer link transducer.” *See, e.g.*, ACI-1004, [0051]; ACI-1005, 2:8-10, 4:33-5:16, 7:7-8:1; ACI-1003, [54]. Further, as described in Section IV.A.6 *supra*, a POSITA would have both found this combination of Aker and Thomas to be obvious and been motivated perform the combination. ACI-1003, [54].

Limitation [9.6]

In the combination, Aker discloses that the “function of the digital signal processor 54 is to ***process the digital samples from channels A and B by performing a complex fast fourier transform on them*** to develop an approaching target Fourier spectrum and a receding target Fourier spectrum and then to analyze one or both of these spectrums to determine a target speed and display it.” ACI-1004, [0049]. As Dr. Anthony explains, “[a] ***Fast Fourier Transform or ‘FFT’*** is

a mathematical operation that *converts a signal in the time domain into a representation in the frequency domain.*” ACI-1003, [56]; *see, e.g.*, ACI-1010, [0056]. Thus, the DSP of Aker performs a time domain to frequency domain conversion (a “fast [F]ourier transform”) on the digital data samples. *See* ACI-1004, [0049]; ACI-1003, [56].

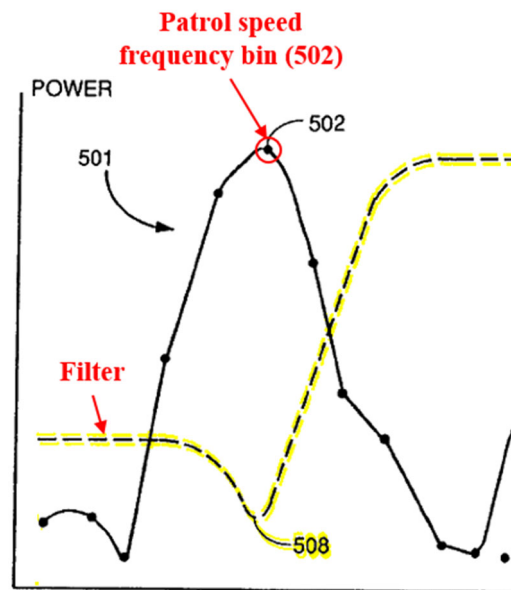
Aker further discloses that the fast fourier transform creates a plurality of “frequency bin[s]” each associated with a “bin number.” *See, e.g.*, ACI-1004, [0091] (“the natural order of both spectra output from the complex FFT is by descending frequency bin”), [0110] (referring to the “top 64 bins” and “the bin number of the candidate”), [0120] (“all bins below the patrol speed but above the strongest target speed”); ACI-1003, [57]. Aker further discloses that each frequency bin has an “apparent power (relative signal magnitude),” and corresponds to a “relative speed” of a target (*e.g.*, a vehicle) to the patrol speed. ACI-1004, [0115], [0120]; ACI-1003, [57].

Limitation [9.7]

In the combination, Aker discloses “*determining the speed of the patrol car either by means of a link to the speedometer,*” such as the GPS-enabled speedometer of Thomas, “or by acquiring and tracking the patrol car speed from returns from stationary objects as is well known he prior art.” ACI-1004, [0064].

Aker further discloses that the received radar returns are passed “through a digital high pass filter *to remove the patrol speed spectral line therefrom.*” *Id.*, [0103]; ACI-1003, [59].

Also in the combination, Aker ’724 discloses that “[o]nce the patrol speed is determined, *the DSP and its control software effectively filter out the patrol speed return at 502* by superimposing a high pass, high quality elliptical filter response with a zero placed at the center frequency of the patrol speed (the zero is shown graphically at 508) over the FFT calculated spectrum.” ACI-1004, 24:61-67; ACI-1003, [60]. FIG. 25 of Aker shows a representation of this filtering process:



Aker ’724, Detail of FIG. 25 (annotated)

As shown in FIG. 25, the frequency bin 502 (which represents the patrol speed) as well as the two adjacent frequency bins (denoted by the two dots next to

502 and contained within the red dashed box annotation) are filtered out by the filter 508. *See* ACI-1007, FIG. 25; ACI-1003, [61]. In order to set the zero point of the filter 508, the patrol speed is converted into the corresponding frequency bin 502. *See id.*

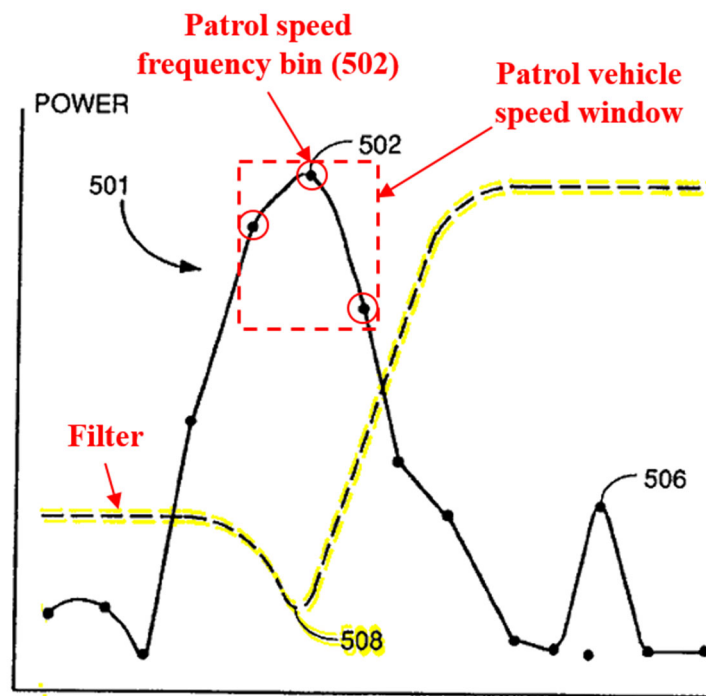
In addition, Aker also discloses an example embodiment where the “patrol car speed is determined from the car's speedometer (as opposed to processing returns from stationary objects such as the ground). . . from which the indicated speed on the speedometer can be determined for use in moving mode target speed calculations.” ACI-1007, [0051]. Thus, Aker discloses converting the speed of the patrol vehicle from the speedometer to a frequency bin number instead of from the Doppler radar signal. *Id.*, [0051]; ACI-1003, [62].

Limitation [9.8]

In the combination, Aker ’724³ discloses that “[o]nce the patrol speed is

³ Aker details this filtering process (*see* ACI-1004, [0103]) and notes that the process is described in greater detail in Aker ’724, which, as discussed above, is referenced throughout Aker and which Aker explicitly incorporates by reference. ACI-1004, [0003] (“The Stalker Dual radar is fully described in U.S. Pat. No. 5,691,724 which has an effective filing date of Feb. 10, 1995, the full contents of

determined, *the DSP and its control software effectively filter out the patrol speed return at 502* by superimposing a high pass, high quality elliptical filter response with a zero placed at the center frequency of the patrol speed (the zero is shown graphically at 508) over the FFT calculated spectrum.” ACI-1007, 24:61-67; ACI-1003, [64]. FIG. 25 of Aker shows a representation of this filtering process:



Aker '724, Detail of FIG. 25 (annotated)

As shown in FIG. 25, the frequency bin 502 (which represents the patrol speed) as well as the two adjacent frequency bins (denoted by the two dots next to which are hereby incorporated by reference.”); *see also* [0052], [0053], [0054], [0084], [0094], [0110].

502 and contained within the red dashed box annotation) are filtered out by the filter 508. *See* ACI-1007, FIG. 25; ACI-1003, [65]. These frequency bins form a patrol vehicle speed window (denoted by the red dashed box annotation) with the frequency bin number of the converted patrol vehicle speed (frequency bin 502) as a center of the range. *See* ACI-1007, FIG. 25; ACI-1003, [65].

Limitation [9.9]

In the combination, Aker discloses a “process of picking the fastest target candidate” from the radar return signals. ACI-1004, [0084]. Aker discloses that “[a]ny known qualification tests on the fastest candidate may be applied, and exhaustive discussion of the fastest target qualification tests used in the Stalker Dual radars in U.S. Pat. No. 5,691,724” (*i.e.*, Aker ’724) “is hereby incorporated by reference and represents a preferred species.” *Id.*; ACI-1003, [67].

Also in the combination, Aker ’724 discloses that “[t]arget identification is performed using an algorithm that ***compares the amplitude level of a Fourier component***” (*i.e.*, frequency bin) “which is thought to represent a target return ***to the amplitude levels of the Fourier components in the neighborhood*** of the selected Fourier component ***to determine if a minimum difference exists.***” ACI-1007, 22:1-6. In greater detail, Aker ’724 discloses that “[f]or target processing, ***the power of each spectral component, i.e., bin, is compared to the power of some***

of its neighboring spectral components to determine if it is a legitimate target return or just noise.” ACI-1007, 23:41-44. “***The power in the selected bin must be 10 db higher than the average power of the 8 neighboring bins to be selected as a target return.***” *Id.*, 23:61-63. Thus, Aker ’724 discloses that the selected bin must have a power (relative magnitude) greater than “the average power of the 8 neighboring bins” (a spike threshold) to be selected as a target return. *See id.*, 23:41-63; *see also* 48:9-41 (describing a “virtual gauntlet of qualification and disqualification tests that the fastest speed candidate” is subjected to, as shown in “FIGS. 23A-E, 24A-E and 29A-G[.]”); ACI-1003, [68].

Aker ’724 further discloses that the target frequency bin numbers are outside the patrol vehicle speed window. Aker ’724 discloses that “[o]nce the patrol speed is determined, ***the DSP and its control software effectively filter out the patrol speed return at 502*** by superimposing a high pass, high quality elliptical filter response with a zero placed at the center frequency of the patrol speed (the zero is shown graphically at 508) over the FFT calculated spectrum.” ACI-1007, 24:61-67. Thus, the target processing described above takes place on the “FFT calculated spectrum” after the frequency bins in the patrol vehicle speed window have been filtered (*e.g.*, zeroed) out, meaning that all of the potential target returns are associated with frequency bins outside the patrol vehicle speed window. *See id.*; ACI-1003, [69]. FIG. 25 of Aker ’724 shows a representation of this filtering

process:

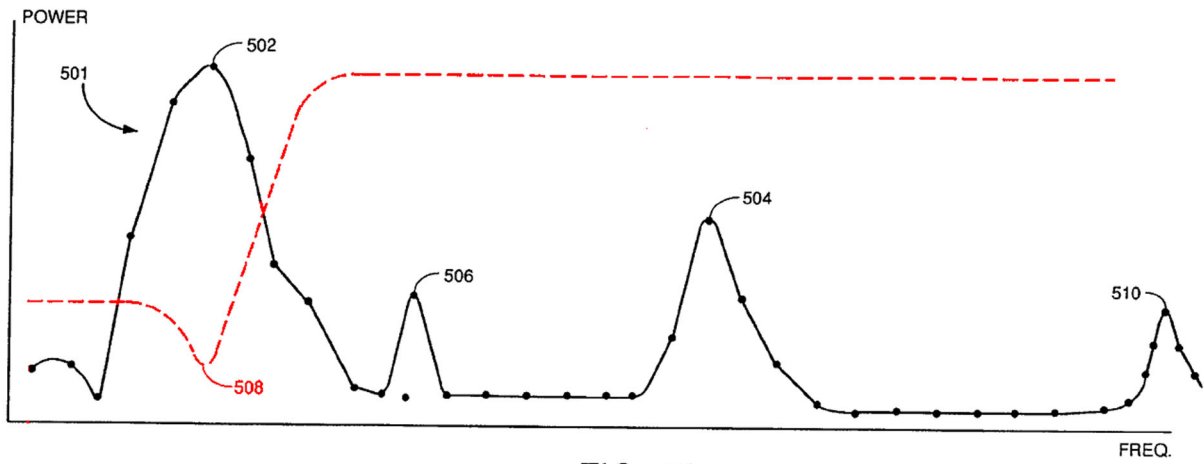


FIG. 25

Aker '724, Detail of FIG. 25 (annotated)

Limitation [9.10]

In the combination, Aker '724 discloses that the “spectral components from the FFT analysis” (*i.e.*, the frequency bins) “are then used to calculate...***target speed of the strongest target return***” (*i.e.*, the relative speed of the target vehicle). ACI-1007, 20:30-33; ACI-1003, [71].

Limitation [9.11]

In the combination, Aker discloses that its system “subtracts patrol speed frequency from strongest target frequency and passes the frequency difference to block 716 where the frequency difference is converted to miles per hour using the relationship that Doppler shift results in a frequency shift of about 103 Hertz per mile per hour.” ACI-1007, 48:4-9; *see also* 10:2-3 (“The speed of the target is

derived from subtracting the patrol speed from the target's closing speed.”). The resulting absolute speed value of the target vehicle is then displayed (e.g., by the counting display unit 12). *See id.*, 48:4-9; *see also* 21:44-47; ACI-1003, [73].

Accordingly, the Aker-Thomas combination renders this limitation obvious.

b) Claim 10

Limitation [10.0]

In the combination, Aker discloses a multimode digital FFT, ***direction sensing, Doppler radar*** where the operator can select between the following modes:

stationary, strongest only, receding only

stationary, strongest only, approaching only

stationary, fastest only, approaching only

stationary, fastest only, receding only

moving, same lane only, strongest only

moving, same lane only, fastest only

moving, opposite lane only, strongest only

moving, opposite lane only, fastest only.”

ACI-1004, [0017]-[0025]; ACI-1003, [75].

Aker further discloses “***automatically determining whether to add or subtract*** the fastest target relative speed from the patrol speed based upon whether

the fastest target was found in the approaching target spectrum or the receding target spectrum.” *Id.*, [0073]; ACI-1003, [76].

Limitation [10.1]

Aker discloses “***automatically determining whether to add or subtract*** the fastest target relative speed from the patrol speed based upon whether the fastest target was found in the approaching target spectrum or the receding target spectrum.” ACI-1004, [0073]; ACI-1003, [78].

Limitation [10.2]

Aker discloses “***automatically determining whether to add or subtract*** the fastest target relative speed from the patrol speed based upon whether the fastest target was found in the approaching target spectrum or the receding target spectrum.” ACI-1004, [0073]; ACI-1003, [79].

Limitation [10.3]

Aker discloses that “if the strongest candidate qualifies, step 240 is performed to calculate its speed by taking the candidate's relative speed and ***subtracting from it the patrol speed.***” ACI-1004, [0108]; ACI-1003, [80].

c) Claim 11

Limitation [11.0]

In the combination, Aker discloses that “the DSP carries out a process to implement a multimode radar where ***operator selection of moving or stationary***

mode...is also provided.” ACI-1004, [0050]. Accordingly, the DSP determines whether the patrol vehicle is moving or stationary based on the mode selection made by the operator. *See id.*; ACI-1003, [82].

As discussed above, Aker discloses “*automatically determining whether to add or subtract* the fastest target relative speed from the patrol speed based upon whether the fastest target was found in the approaching target spectrum or the receding target spectrum.” ACI-1004, [0073]. This addition/subtraction of the patrol is not performed if the unit is in stationary mode (*i.e.*, not moving). *Id.*, [0062] (“The fastest target found is then converted to speed.”), FIG. 7, FIG. 8; ACI-1003, [83].

d) Claim 14

Limitation [14.0]

In the combination, Aker discloses that the traffic radar system includes a “[d]isplay 60” that “typically has *three display windows, one for patrol speed* in moving modes, *one for the strongest target's speed* and *one for the fastest target's speed*.” ACI-1004, [00050]; ACI-1003, [84].

Accordingly, the Aker-Thomas combination renders this limitation obvious.

e) Claim 1

Limitation [1.0]

See [9.0] supra.

Limitation [1.1]

See [9.1] supra.

Limitation [1.2]

See [9.2] supra. In the combination, the GPS-enabled speedometer of Thomas (the speed determining element) only provides the “current-vehicle-speed signal” to the DSP of Aker (the processing element), and does not receive any signals or data from the DSP. ACI-1003, [88]; *see, e.g.*, ACI-1005, 4:33-5:16 (speedometer only “receive[s] a signal from...global positioning satellites”); ACI-1004, [0051], [0099] (the DSP “read[s] the transducer and calculate[s] the patrol speed from data acquired from it”).

Limitation [1.3]

See [9.3] supra.

Limitation [1.4]

See [9.4] supra.

Limitation [1.5]

See [9.5] supra.

Limitation [1.6]

See [9.6] supra.

Limitation [1.7]

See [9.7] supra.

Limitation [1.8]

See [9.8] supra.

Limitation [1.9]

See [9.9] supra.

Limitation [1.10]

See [9.10] supra.

Limitation [1.11]

See [9.11] supra.

f) Claim 2

Limitation [2.0]

See [10.0] supra.

Limitation [2.1]

See [10.1] supra.

Limitation [2.2]

See [10.2] supra.

Limitation [2.3]

See [10.3] supra.

g) Claim 3

Limitation [3.0]

See [11.0] supra.

h) Claim 6

Limitation [6.0]

See [9.2] supra.

i) Claim 7

Limitation [7.0]

See [14.0] supra.

j) Claim 8

Limitation [8.0]

In the combination, Aker discloses that “the channel A and channel B outputs on lines 40 and 42 are coupled to the inputs of a pair of amplifiers 44 and 46.” ACI-1004, [0046]. “The outputs of the amplifiers are coupled...to the input of *analog-to-digital converters 48 and 50.*” *Id.*, [0047]. “The function of the A/D converters 48 and 50 is to *sample the analog signals on lines 51 and 53 and output these samples as digital sample values on buses 56 and 58 coupled to digital signal processor 54.*” *Id.*, [0048]; ACI-1003, [105]. Accordingly, the Aker-Thomas combination renders this limitation obvious.

k) Claim 15

Limitation [15.0]

See [8.0] supra.

B. Ground 1B: Claims 3-5 and 11-13 are obvious over Aker, Aker ’724, and Thomas in view of Carmichael

1. The combination of Aker, Aker ’724, Thomas, and Carmichael

In the combination, the radar system of the previous Aker-Thomas

combination is modified based on the teachings of Carmichael to automatically detect, based on vehicle speed, whether the vehicle is moving or stationary. *See* ACI-1006, claim 9; *see also* [0062].

2. Reasons to combine Aker, Aker '724, Thomas, and Carmichael

It would have been obvious to a POSITA to modify the previous Aker-Thomas combination to automatically detect, based on vehicle speed, whether the vehicle is moving or stationary, as taught by Carmichael. ACI-1003, [108]. For example, as disclosed in Carmichael, “[*for ease of operation, it is desirable* to have the radar device automatically switch over to stationary mode if the patrol vehicle is stopped,” and “likewise, *it is also desirable* to have the radar device to switch back to moving mode once the patrol vehicle is moving again.” ACI-1006, [0062]. A POSITA would have been aware of the desirability of these features based on Carmichael’s disclosure, and thus would have been motivated to incorporate the automatic movement detection of Carmichael into the Aker-Thomas combination. *See id.*; ACI-1003, [108].

Further, a POSITA would have found it obvious to modify the previous Aker-Thomas combination based on Carmichael’s teachings because doing so entails the use of known solutions to improve similar systems and methods in the same way. ACI-1003, [109]. Here, “when a patent ‘simply arranges old elements

with each performing the same function it had been known to perform' and yields no more than one would expect from such an arrangement, the combination is obvious." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). A POSITA would have recognized that applying Carmichael's teachings to augment the Aker-Thomas system would have led to predictable results without significantly altering or hindering the functions performed by the Aker-Thomas system. ACI-1003, [109].

In fact, a POSITA would have been motivated to incorporate the well-known techniques of Carmichael into the Aker-Thomas system to achieve the predictable benefits described in Carmichael. ACI-1003, [110]; *see, e.g.*, ACI-1006, [0062]. Indeed, a POSITA would have had a reasonable expectation of success incorporating Carmichael's teachings into the Aker-Thomas system, because Carmichael discloses a radar device operating in the proposed manner. *See* ACI-1006, [0062]; ACI-1003, [110].

Accordingly, for at least these reasons, augmenting the Aker-Thomas system based on the teachings of Carmichael would have been routine and straightforward to a POSITA, and it would have been clear that such a combination would predictably work and provide the expected results. *Id.*; ACI-1003, [111].

3. Analysis

a) Claim 11

Limitation [11.0]

In the combination, Carmichael discloses a “radar device” having “a moving mode and a stationary mode,” that “*automatically switch[es] to the stationary mode if the vehicle speed information indicates that the speed of the vehicle is zero and automatically switch[es] to the moving mode if the vehicle speed information is not zero.*” ACI-1006, claim 9; *see also* [0062]; ACI-1003, [112]. As described above (*see* Section IV.B.2 *supra*), a POSITA would have been motivated to incorporate these features into the prior Aker-Thomas combination. ACI-1003, [112].

As discussed above, Aker discloses “automatically determining whether to add or subtract the fastest target relative speed from the patrol speed based upon whether the fastest target was found in the approaching target spectrum or the receding target spectrum.” ACI-1004, [0073]. This addition/subtraction of the patrol is not performed if the unit is in stationary mode (*i.e.*, not moving). *Id.*, [0062] (“The fastest target found is then converted to speed.”), FIG. 7, FIG. 8; ACI-1003, [113].

Accordingly, the Aker-Thomas-Carmichael combination renders this limitation obvious.

b) Claim 12

Limitation [12.0]

As previously discussed, in the combination, Thomas discloses a “controller 10” (*i.e.*, a speed determining element) that “includes a receiver 12 to ***receive a signal from...global positioning satellites.***” ACI-1005, 4:33-5:3. The controller 10 “***calculate[s]***” a “***current-vehicle-speed signal...from GPS (global positioning data).***” *Id.*, 2:8-10; *see also* 7:7-8:1 (“The information available from the GPS system can be used to calculate speed, therefore obviating the need for a separate speed sensor 22 input.”); ACI-1003, [115]. In Thomas’s system, the controller 10 outputs the “current-vehicle-speed signal” to a comparator which compares it to a speed limit signal. ACI-1005, 4:33-5:16; ACI-1003, [115]. Because the current vehicle speed changes with time, Thomas’s controller 10 sends a stream of messages at regular intervals including the current vehicle speed. *See id.* These messages comprise the “current-vehicle-speed signal” described in Thomas. *See id.*

Limitation [12.1]

As previously discussed, in the combination, Carmichael discloses a “radar device” having “a moving mode and a stationary mode,” that “automatically switch[es] to the stationary mode if the vehicle speed information indicates that the speed of the vehicle is zero and ***automatically switch[es] to the moving mode if the vehicle speed information is not zero.***” ACI-1006, claim 9; *see also* [0062]. Thus, if the patrol vehicle speed is greater than zero (a first threshold) for a pre-determined number of successive messages (*e.g.*, one) the patrol vehicle is

determined to be moving. *See id.*; ACI-1003, [116].

Limitation [12.2]

As previously discussed, in the combination, Carmichael discloses a “radar device” having “a moving mode and a stationary mode,” that “***automatically switch[es] to the stationary mode if the vehicle speed information indicates that the speed of the vehicle is zero*** and automatically switch[es] to the moving mode if the vehicle speed information is not zero.” ACI-1006, claim 9; *see also* [0062]. Thus, if the patrol vehicle speed is zero (*i.e.*, less than a positive second threshold) for a pre-determined number of successive messages (*e.g.*, one) the patrol vehicle is determined to be stationary. *See id.*; ACI-1003, [117].

c) Claim 13

Limitation [13.0]

See [11.0] *supra*.

d) Claim 3

Limitation [3.0]

See [11.0] *supra*.

e) Claim 4

Limitation [4.0]

See [12.0], [12.1] *supra*.

f) Claim 5

Limitation [5.0]

See [12.0], [12.2] *supra*.

C. Ground 2A: Claims 1-3, 6-11, 14, and 15 are obvious over Shelton in view of Henderson and Thomas

1. Overview of Shelton

Shelton discloses a “digital signal processor (DSP) traffic radar utilizing pulses from the patrol vehicle's electronic speedometer to steer the DSP's search of Doppler return information for the patrol vehicle's radar return signal, to improve target identification and minimize inaccuracies.” ACI-1008, Abstract.

2. Overview of Henderson

Similar to Shelton, Henderson discloses a “traffic radar [that] processes Doppler return information by analysis of the received frequency spectrum in order to improve target identification and minimize interference and unwanted harmonics.” ACI-1008, Abstract. “Digital signal processing including transformation of the return information into the frequency domain is employed to provide multiple modes of operation including a stationary mode where either the strongest or the fastest Doppler return signal may be selectively recognized, and moving modes for monitoring traffic moving in both the opposite direction and the same direction as the patrol vehicle.” *Id.*

3. The combination of Shelton, Henderson, and Thomas

In the combination, the traffic radar system of Shelton is further detailed in the Henderson patent, which Shelton references multiple times. *See, e.g.*, ACI-

1008, 1:19-21 (“such a DSP radar is disclosed, for example, in U.S. Pat. No. 5,528,246 to Henderson et al., owned by the assignee herein”), 3:4-12; ACI-1003, [124].

In addition, in the combination, the traffic radar system disclosed in Shelton and Henderson is modified such that the controller 10 from Thomas (including the GPS receiver 12) provides a “current-vehicle-speed signal” calculated based on the GPS data to the electronic speedometer interface of the DSP in Shelton. ACI-1005, 2:8-10, 4:33-5:16; ACI-1008, 2:44-3:3; ACI-1003, [125]. Shelton discloses receiving a current vehicle speed from a speedometer, without limitation to any specific type of speedometer and thus is compatible with a GPS speedometer such as that described by Thomas. ACI-1008, 2:44-3:3; ACI-1003, [125].

4. Reasons to combine Shelton and Henderson

A POSITA examining Shelton would have looked to Henderson for more information on the operation of Shelton’s traffic radar system because Shelton repeatedly and specifically directs the reader to Henderson for just such information. *See, e.g.*, ACI-1008, 1:19-21 (“such a DSP radar is disclosed, for example, in U.S. Pat. No. 5,528,246 to Henderson et al., owned by the assignee herein”), 3:4-12; ACI-1003, [126]. Although the text of Henderson is not explicitly incorporated by reference into Shelton, a POSITA would nonetheless have been motivated to obtain more information when implementing the traffic radar system

described in Shelton, and would have been directed to Henderson by Shelton's specific instructions. ACI-1003, [126]. The result of this combination would have been predictable because Shelton and Henderson describe similar traffic radar system, and thus this portion of the combination involves no material change to the traffic radar system of Shelton. ACI-1003, [126].

In addition, it would have been obvious to a POSITA to modify the "DSP traffic radar unit" of Shelton based on the teachings of Henderson to include a "rear antenna" in addition to the front-facing "antenna 12," and to include a "control button" on the "DSP traffic radar unit" to select either the front or rear antenna for monitoring. ACI-1003, [127]. In the combination, radar signals received by the rear antenna would be processed in the same manner as signals received by the front-facing antenna 12 in Shelton, and only signals from one of the front or rear antenna would be processed at any time based on the control button selection (as taught by Henderson). *See* ACI-1008, 2:20-29; ACI-1009, 4:24-26, 6:7-9, 8:15-17; ACI-1003, [127]. A POSITA would have been motivated to perform this modification to expand the capabilities of Shelton's "DSP traffic radar unit" to include determining the speed of targets both in the front and rear area of the patrol vehicle as opposed to only the front area, allowing a greater range of targets to be analyzed without the need to reposition to the patrol vehicle such that the targets are located in the front area. *See* ACI-1008, 2:20-29; ACI-

1009, 4:24-26, 6:7-9, 8:15-17; ACI-1003, [127]. The results of this modification would have been predictable because Henderson teaches a DSP traffic radar unit operating in the proposed manner. *See* ACI-1009, 4:24-26, 6:7-9, 8:15-17; ACI-1003, [127].

5. Reasons to combine Shelton/Henderson and Thomas

It would have been obvious to a POSITA to modify the Shelton/Henderson radar system to receive current vehicle speed data from a GPS-enabled speedometer, as taught by Thomas. ACI-1003, [128]. Thomas states that “[t]he information available from the GPS system can be used to calculate speed, therefore obviating the need for a separate speed sensor input.” ACI-1005, 7:32-8:1. Thomas discloses such sensors as “largely mechanical and tend to be complex and expensive to fit to a vehicle.” *Id.*, 1:12-13. Eliminating such sensors may simplify the vehicle design, leading to a more robust final product. ACI-1003, [128]. Further, in the event of an issue with the existing speedometer in a vehicle, such as inaccuracy or mechanical issue, a POSITA would have been motivated to incorporate Thomas’ GPS speedometer, which Thomas emphasizes “can be retrofitted to 99% of cars on the road today.” ACI-1005, 4:30-31; ACI-1003, [128].

In addition, Thomas stresses the ease with which its GPS speedometer can be incorporated into a vehicle, stating that the “controller 10 of the present invention can be connected to almost any vehicle in the world” (*id.*, 4:15-16), and

that “[t]he controller can be retro-fitted to 99% of cars on the road today” with an “[a]verage installation tak[ing] around 3 hours” (*id.*, 4:30-31). While ease of performing a combination does not necessarily represent a motivation for a POSITA to do so, these quotes make clear that incorporating Thomas’s GPS-enabled speedometer would have been accomplished by a POSITA. ACI-1003, [129].

Further, a POSITA would have found it obvious to modify Shelton/Henderson based on Thomas’s teachings because doing so entails the use of known solutions to improve similar systems and methods in the same way. ACI-1003, [130]. Here, “when a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). A POSITA would have recognized that applying Thomas’s teachings to augment Shelton/Henderson would have led to predictable results without significantly altering or hindering the functions performed by the Shelton/Henderson system. ACI-1003, [130].

In fact, a POSITA would have been motivated to incorporate the well-known techniques of Thomas into Shelton/Henderson to achieve the predictable benefits described in Thomas. ACI-1003, [131]; *see, e.g.*, ACI-1005, 1:12-13, 7:32-8:1. Indeed, a POSITA would have had a reasonable expectation of success

incorporating Thomas's teachings into Shelton/Henderson, because both Shelton and Thomas discloses a device operating in the proposed manner. ACI-1008, 2:44-3:3; ACI-1005, 1:12-13, 2:8-10, 4:33-5:16, 7:7-8:1; ACI-1003, [131].

Accordingly, for at least these reasons, augmenting Shelton/Henderson's device based on the teachings of Thomas would have been routine and straightforward to a POSITA, and it would have been clear that such a combination would predictably work and provide the expected results. *Id.*; ACI-1003, [132].

6. Analysis

a) Claim 9

Limitation [9.0]

To the extent the preamble is limiting, the Shelton-Henderson-Thomas combination renders it obvious. For example, in the combination, Shelton discloses a “digital signal processor (DSP) ***traffic radar*** utilizing pulses from the patrol vehicle's electronic speedometer to steer the DSP's search of Doppler return information for the patrol vehicle's radar return signal, to improve target identification and minimize inaccuracies.” ACI-1008, Abstract; ACI-1003, [133].

Limitation [9.1]

In the combination, Shelton discloses “a DSP radar unit 10 with ***an antenna 12***” (a first radar transceiver) “***for sending***” (*i.e.*, transmitting) “***and receiving radar signals***.” ACI-1008, 2:20-21. Radar signals would include reflected beams

and/or scattered reflected signals, depending on the orientation and properties of the target. *See id.*; ACI-1003, [XX]. Shelton discloses that “[i]t should be understood that [the] DSP traffic radar unit transmits a single frequency microwave signal toward moving and stationary targets,” and that a “portion of the microwave signal is reflected by the targets and is received, mixed, and amplified by the receiver section of antenna 12.” *Id.*, 2:24-29. “The signal received is a composite of all signals reflected by the moving and stationary targets.” *Id.*, 2:29-30; ACI-1003, [134].

Shelton further discloses that “[*r*]adar return signals received by antenna 12 are converted from analog to digital by A to D converter 14, and input to signal processing system 16 containing a digital signal processor (DSP).” *Id.*, 2:21-24. The analog signal from the antenna 12 converted to digital by the A to D converter 14 is thus a first electronic signal corresponding to the received radar signals. *See id.*, 2:20-24; ACI-1003, [135].

In its background section, Shelton states that a prior art DSP radar unit “is disclosed, for example, in U.S. Pat. No. 5,528,246 to Henderson et al., owned by the assignee herein.” *Id.*, 1:19-21. U.S. Patent No. 5,528,246 is the Henderson reference (ACI-1009), which, as described above, is a component of the present combination. ACI-1003, [136].

In the combination, Henderson discloses a “DSP traffic radar unit” to

operates similarly to the unit described in Shelton. *Compare* ACI-1008, 2:20-29 with ACI-1009, 8:15-17. Like Shelton, Henderson discloses that “an antenna” on the radar unit “transmits a microwave carrier and any portion reflected off any surface towards the receive antenna is processed by the DSP” of the unit. ACI-1009, 8:15-17. “Any portion” would include the entire portion, *i.e.* the entire beam. *See id.*, ACI-1003, [137]. Henderson further discloses that its radar unit includes “**front and rear antennas 240 and 242**, respectively, on the patrol vehicle [for] forward or rearward propagation of the transmitted carrier.” *Id.*, 4:24-26. A “[c]ontrol button 284” on the radar unit “**selects either the front or rear antenna** for monitoring traffic to the front or rear of the patrol vehicle.” *Id.*, 6:7-9. Henderson thus indicates that only one of the front and rear antennas may be active at any time. *See id.*; ACI-1003, [137].

As described above (*see* Section IV.C.4 *supra*), it would have been obvious to a POSITA to modify the “DSP traffic radar unit” of Shelton based on the teachings of Henderson to include a “rear antenna” (a radar transceiver) in addition to the front-facing “antenna 12” (also a radar transceiver), and to include a “control button” on the “DSP traffic radar unit” to select either the front or rear antenna for monitoring. ACI-1003, [138]. In the combination, radar signals received by the rear antenna would be processed in the same manner as signals received by the front-facing antenna 12 in Shelton. *See* ACI-1008, 2:20-29. Thus, in the

combination, “[r]adar return signals received by” the rear antenna “are *converted from analog to digital* by A to D converter 14, and input to signal processing system 16 containing a digital signal processor (DSP).” *Id.*, 2:21-24. The analog signal from the rear antenna converted to digital by the A to D converter 14 is thus a second electronic signal corresponding to the received radar signals. *See id.*, 2:20-24; ACI-1003, [138].

A POSITA would have been motivated to perform this modification for at least the reasons discussed above (*see* Section IV.C.4 *supra*). ACI-1003, [139].

Under the First Interpretation of this limitation (*see* Section III.A.1 *supra*), either the front or rear antennas from the Shelton-Henderson-Thomas device disclose a “radar transceiver configured to transmit and receive radar beams in a front zone...or in a rear zone.” The Shelton-Henderson-Thomas front antenna is configured to transmit and receive in a front zone, and its rear antenna is configured to transmit and receive in a rear zone. *See, e.g.*, ACI-1009, 4:24-26, 8:15-17; ACI-1003, [140]. Under the First Interpretation, the radar transceiver need only be configured to transmit and receive in either the front zone or the rear zone, so under this interpretation the limitation is satisfied by either of the Shelton-Henderson-Thomas antennas. *See* Section III.A.1 *supra*; ACI-1009, 4:24-26, 8:15-17; ACI-1003, [140].

Limitation [9.2]

In the combination, Thomas discloses a “controller 10” (*i.e.*, a speed determining element) that “includes a receiver 12 to *receive a signal from...global positioning satellites.*” ACI-1005, 4:33-5:3. The controller 10 “*calculate[s]*” a “*current-vehicle-speed signal...from GPS (global positioning data).*” *Id.*, 2:8-10; *see also* 7:7-8:1 (“The information available from the GPS system can be used to calculate speed, therefore obviating the need for a separate speed sensor 22 input.”); ACI-1003, [142]. In Thomas’ system, the controller 10 outputs the “current-vehicle-speed signal” to a comparator which compares it to a speed limit signal. ACI-1005, 4:33-5:16; ACI-1003, [142].

Also in the combination, Shelton discloses that its system includes an “electronic speedometer 20” that “outputs a certain number of pulses for each mile the patrol vehicle travels.” ACI-1008, 2:44-45. In Shelton, “[t]he electronic speedometer output pulses are interfaced to the DSP in signal processing system 16 by way of a level converter and a Schmitt trigger logic circuit known in the art, to an edge sensitive interrupt pin on the DSP chip[.]” *Id.*, 2:64-3:3. “The DSP calls an interrupt service routine that counts pulses each time a speedometer pulse is received.” *Id.*, 3:2-3; ACI-1003, [143].

As described above in Section IV.C.3 *supra*, in the present combination, the controller 10 from Thomas (including the GPS receiver 12) provides a pulse signal representing the current vehicle speed as calculated based on the GPS data to the

DSP of Shelton (the processing element, *see* [9.3] *infra*) in the same manner as the “electronic speedometer” described therein. In addition, as described in Section IV.C.5 *supra*, a POSITA would have both found the combination obvious and been motivated perform the combination. ACI-1003, [144].

Limitation [9.3]

In the combination, Shelton discloses that its radar unit includes a “***digital signal processor (DSP)***” (a processing element) that performs various processing tasks related to target speed determination. *See, e.g.*, ACI-1008, 2:19-34, 2:39-3:3, 3:16-30; ACI-1003, [146].

Limitation [9.4]

As previously discussed, in the combination, Shelton discloses that “[r]adar return signals received by antenna 12 ***are converted from analog to digital*** by A to D converter 14, ***and input to signal processing system 16 containing a digital signal processor (DSP).***” ACI-1008, 2:21-24. As Dr. Anthony explains: “A POSITA would have understood that converting a continuous analog signal (such as the radar return signals) into digital format involves sampling the analog signal to produce digital data samples.” ACI-1003, [148]; *see, e.g.*, ACI-1007, 10:28-52 (“In general, the received data at the antenna is sampled at typically 44 kHz and each sample results in a 16-bit serial data word produced by the Analog to Digital Converter.”); ACI-1004, [0048] (“The function of the A/D converters 48 and 50 is

to sample the analog signals on lines 51 and 53 and output these samples as digital sample values on buses 56 and 58 coupled to digital signal processor 54.”); ACI-1009, 4:53-64.

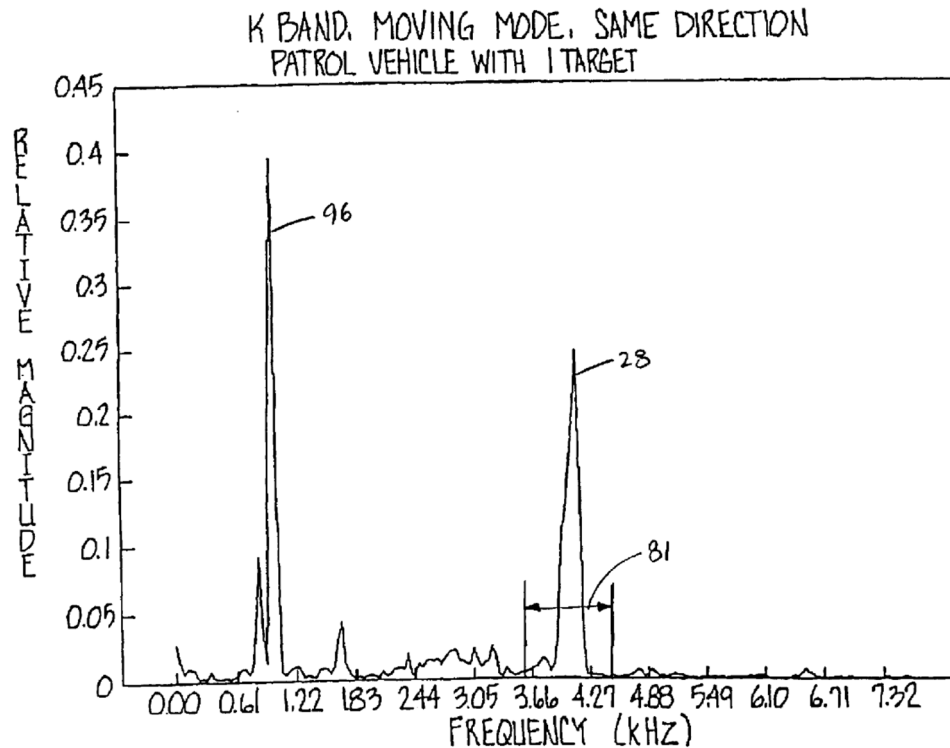
Limitation [9.5]

In Shelton, “[t]he electronic speedometer output pulses are interfaced to the DSP in signal processing system 16 by way of a level converter and a Schmitt trigger logic circuit known in the art, to an edge sensitive interrupt pin on the DSP chip[.]” *Id.*, 2:64-3:3. “The DSP calls an interrupt service routine that counts pulses each time a speedometer pulse is received.” *Id.*, 3:2-3. “A common value of speedometer pulses is 8,000 pulses per mile,” so “when the patrol vehicle is traveling at a speed of one mile per hour, the speedometer will output (8,000 pulses per mile * 1 mile per hour) pulses per hour.” *Id.*, 2:45-49. Shelton discloses that the DSP calculates the patrol vehicle speed from these pulses. *See id.*, 2:44-3-3; ACI-1003, [150].

Limitation [9.6]

In the combination, Shelton discloses that “***conversion of the signal from the time domain to the frequency domain by the DSP separates the targets by frequency,***” (a plurality of frequency bins) “which is directly proportional to the speed of the target.” ACI-1008, 2:31-34; ACI-1003, [XX]. FIG. 5 from Shelton shows the result of this conversion, in which each frequency bin (shown on the X-

axis) is associated with a “relative magnitude” (shown on the Y-axis). ACI-1003, [152]:

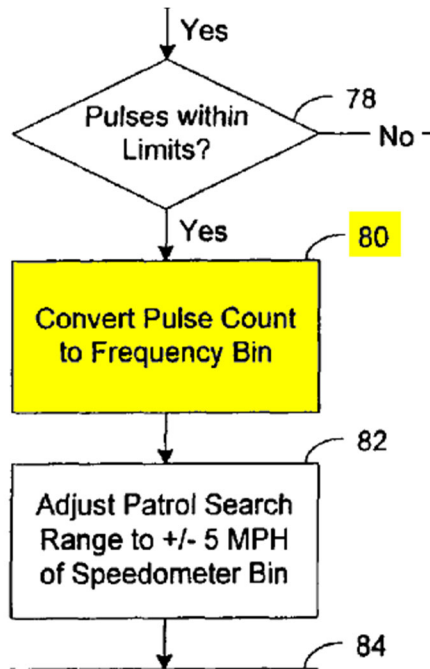


Shelton, Detail of FIG. 5

Limitation [9.7]

In the combination, Shelton discloses that “the operator requests to synchronize the speedometer input to the patrol vehicle radar return 28, which is transformed from the time domain to the frequency domain by the DSP of signal processing system 16.” ACI-1008, 3:16-20. In this way, “the pulse count” from the speedometer “is *converted* from the time domain *to the equivalent bin number* in the frequency domain of the Doppler spectra.” ACI-1008, 4:12-14; *see also* 1:53-

58; ACI-1003, [154]. FIG. 4 from Shelton shows this step:

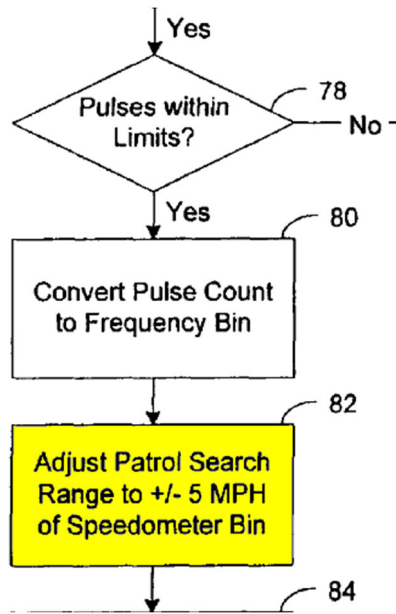


Shelton, Detail of FIG. 4 (annotated)

Limitation [9.8]

In the combination, Shelton discloses that the “*patrol speed search window 81 is set to plus or minus five MPH (or KPH) of the speedometer bin 82.*” ACI-1008, 1:53-58 (“The signal processing system of the radar unit converts the pulses from the speedometer and calculates the speedometer speed. Using this speed as the center of a search window, the system searches for the patrol vehicle radar return signal that falls within the search window.”); 4:16-18; *see also* claim 1 (“providing a search window around said patrol vehicle speedometer speed, said window having a lower boundary less than said patrol vehicle speedometer speed and an upper boundary greater than said patrol vehicle speedometer speed.”); ACI-

1003, [156]. FIG. 4 from Shelton shows this step:



Shelton, Detail of FIG. 4 (annotated)

Limitation [9.9]

In the combination, Henderson discloses that “[o]nce the patrol speed has been determined, the target vehicle speed may be processed.” ACI-1009, 7:4-5.

Henderson discloses several modes of operation for its radar system, including:

- “3. Moving mode, opposite direction, strongest signal
4. Moving mode, opposite direction, fastest signal
5. Moving mode, same direction, normal processing
6. Moving mode, same direction, slower target processing.”

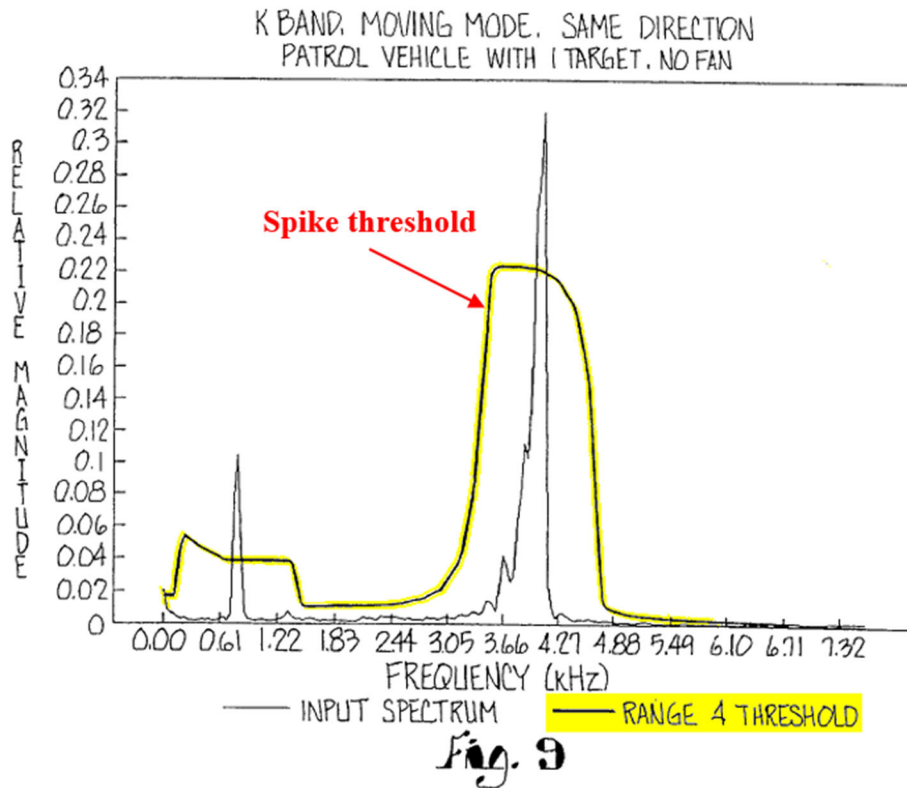
ACI-1009, 5:25-31; ACI-1003, [158] .

Henderson discloses that, in each of these moving modes, the target

frequency bin identified will be outside of the patrol speed window. ACI-1009, 7:15-17 (Moving mode, opposite direction, strongest signal – “Since this will result in all target vehicle Doppler frequencies being greater than that of the patrol vehicle, the DSP is only required to process those frequencies.”), 7:34-35 (Moving mode, opposite direction, fastest signal – “identical to opposite direction, strongest signal”), 7:47-50 (Moving mode, same direction – “In this case, the target vehicle frequencies may be lower or higher than that of the patrol vehicle depending on target vehicle speed relative to that of the patrol vehicle.”); ACI-1003, [159].

Further, the target frequency bin must be outside the patrol vehicle speed window in order for the device to accurately identify and determine the speed of targets, because otherwise the patrol speed return could be erroneously identified as a target. *See id.*; ACI-1003, [16].

Also in the combination, Henderson discloses that “[t]he sensitivity of the input spectrum is then gauged by computing a weighted, moving average of the input spectrum as illustrated in FIG. 9 by the ***range 4 threshold***” (spike threshold). ACI-1009, 4:65-67; ACI-1003, [161]. “A frequency peak must be of a greater magnitude than the weighted, moving average at that frequency in order to be considered valid by the DSP 202.” ACI-1009, 5:5-7. FIG. 9 from Henderson shows the spike threshold applied to a set of radar returns in the frequency domain. ACI-1003, [161]:



ACI-1009, FIG. 9 (annotated)

Limitation [9.10]

In the combination, Henderson discloses that “[i]n this case, the Doppler return of the target vehicle will be the frequency shift directly proportional to the speed of the target vehicle added to that of the patrol vehicle. Stated mathematically: *relative target vehicle frequency = absolute patrol vehicle frequency+absolute target vehicle frequency.*” ACI-1009, 7:7-14. “Therefore, in order to determine the target vehicle frequency, the patrol vehicle frequency must be subtracted from the combined target-patrol frequency.” *Id.*, 7:17-20. “The result is then converted to speed units and sent to the MCU 200.” *Id.*, 7:25-26; ACI-1003,

[163].

Limitation [9.11]

In the combination, Henderson discloses multiple different procedures for converting the relative speed of the target vehicle to an absolute speed. The procedures differ depending on the current mode of operation of the radar unit, which can be any of the following:

- “1. Stationary mode, strongest signal
2. Stationary mode, fastest signal
3. Moving mode, opposite direction, strongest signal
4. Moving mode, opposite direction, fastest signal
5. Moving mode, same direction, normal processing
6. Moving mode, same direction, slower target processing.”

ACI-1009, 5:25-31. For example, in the “moving mode, opposite direction, strongest signal” mode, Henderson states that “in order to determine the target vehicle frequency, *the patrol vehicle frequency must be subtracted from the combined target-patrol frequency*...The result is then converted to speed units and sent to the MCU 200.” *Id.*, 7:17-26; ACI-1003, [165]-[166].

b) Claim 10

Limitation [10.0]

In the combination, Henderson discloses multiple different modes of operation, including:

- “1. Stationary mode, strongest signal
2. Stationary mode, fastest signal
3. Moving mode, *opposite direction*, strongest signal
4. Moving mode, *opposite direction*, fastest signal
5. Moving mode, *same direction*, normal processing
6. Moving mode, *same direction*, slower target processing.”

ACI-1009, 5:25-31. As shown, these modes specify different directions of patrol of the patrol vehicle and the target vehicle. *See id.*; ACI-1003, [168]-[169].

Limitation [10.1]

In the combination, Henderson discloses that “[i]n normal same direction (slower patrol speed) the DSP 202 obtains the target vehicle frequency by *adding the strongest signal's frequency to that of the patrol vehicle.*” ACI-1009, 7:57-59; ACI-1003, [170].

Limitation [10.2]

In the combination, Henderson discloses that “[i]n slower mode same direction processing (faster patrol speed) the DSP obtains the target vehicle

frequency by *subtracting the strongest signal's frequency from that of the patrol vehicle[.]*” ACI-1009, 7:59-63; ACI-1003, [172].

Limitation [10.3]

In the “moving mode, opposite direction, strongest signal” mode, Henderson states that “in order to determine the target vehicle frequency, *the patrol vehicle frequency must be subtracted from the combined target-patrol frequency*...The result is then converted to speed units and sent to the MCU 200.” ACI-1009, 7:17-26; ACI-1003, [174].

c) Claim 11

Limitation [11.0]

In the combination, Shelton discloses that the “operator interface, *including mode selection* and data display, is included in logic control system 18.” ACI-1008, 2:35-36. Shelton discloses that “[c]onfiguration and control of a traffic radar unit is typically accomplished using buttons on the front panel of the radar unit and on the remote control unit (as illustrated for example in the U.S. Pat. No. 5,528,246)” which is the Henderson reference. *Id.*, 3:4-7. Henderson discloses that “The modes of operation which may be selected are as follows:

1. *Stationary mode*, strongest signal

2. ***Stationary mode***, fastest signal
3. ***Moving mode***, opposite direction, strongest signal
4. ***Moving mode***, opposite direction, fastest signal
5. ***Moving mode***, same direction, normal processing
6. ***Moving mode***, same direction, slower target processing.”

ACI-1009, 5:23-31. Accordingly, the DSP determines whether the patrol vehicle is moving or stationary based on the mode selection made by the operator. *See id.*; ACI-1003, [176]-[177].

Henderson further teaches that selection of stationary mode “configures the DSP 202 to accept all return frequencies as absolute Doppler returns, meaning that the target vehicle's speed is directly proportional to the received frequency,” and thus is not based on the patrol speed. ACI-1009, 6:21-25; ACI-1003, [178]. By contrast, Henderson teaches that “[w]hen the DSP 202 is placed into the moving mode of operation (blocks 87-90, FIG. 25), the patrol vehicle speed must be determined prior to target speed determination because the antenna is also in motion, thus altering the Doppler frequency shifts of any target vehicle return signals.” ACI-1009, 6:55-59. Thus, the patrol speed is used to determine the absolute target speed only in the moving mode. *See id.*, 6:21-25, 6:55-59; ACI-1003, [178].

d) Claim 14

Limitation [14.0]

In the combination, Henderson discloses the “[t]he digital LED displays illustrated are typical of conventional traffic radar units. *The digital display 204 shows the speed of the target vehicle, display 206 shows the locked target vehicle speed, and display 208 shows the speed of the patrol vehicle when one of the moving modes of operation is selected.*” ACI-1009, 5:37-44; ACI-1003, [180].

e) Claim 1

Limitation [1.0]

See [9.0] supra.

Limitation [1.1]

See [9.1] supra.

Limitation [1.2]

See [9.2] supra.

Limitation [1.3]

See [9.3] supra.

Limitation [1.4]

See [9.4] supra.

Limitation [1.5]

See [9.5] supra.

Limitation [1.6]

See [9.6] supra.

Limitation [1.7]

See [9.7] supra.

Limitation [1.8]

See [9.8] supra.

Limitation [1.9]

See [9.9] supra.

Limitation [1.10]

See [9.10] supra.

Limitation [1.11]

See [9.11] supra.

f) Claim 2

Limitation [2.0]

See [10.0] supra.

Limitation [2.1]

See [10.1] supra.

Limitation [2.2]

See [10.2] supra.

Limitation [2.3]

See [10.03] supra.

g) Claim 3

Limitation [3.0]

See [11.0] supra.

h) Claim 6

Limitation [6.0]

See [9.2] supra.

i) Claim 7

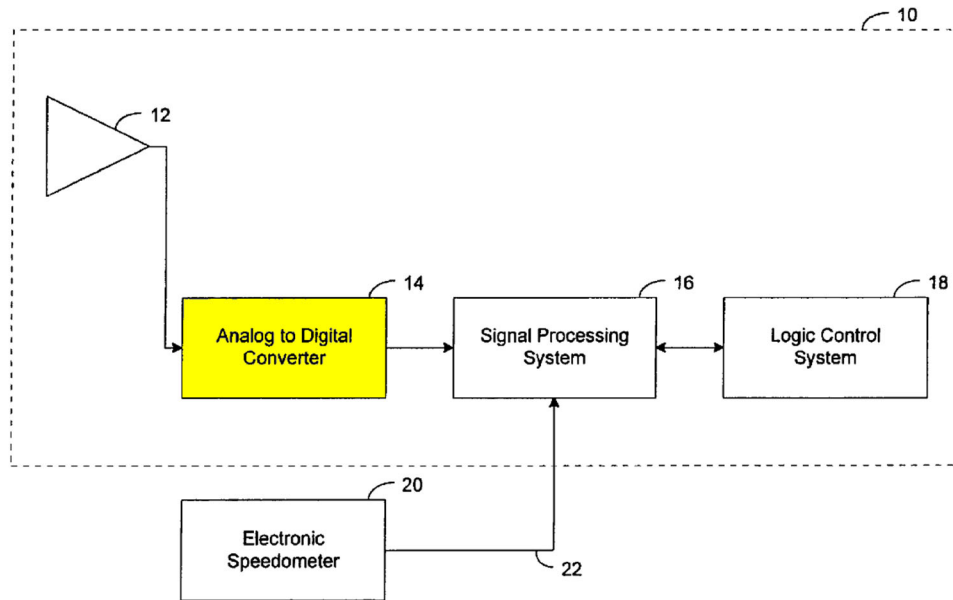
Limitation [7.0]

See [14.0] supra.

j) Claim 8

Limitation [8.0]

In the combination, Shelton discloses that “[r]adar return signals received by antenna 12 are converted from analog to digital by A to D converter 14, and input to signal processing system 16.” ACI-1008, 2:21-24; *see also* ACI-1009, 4:8-17, 4:50-53 (describing “conversion” of the radar returns “into digital data by the...analog-to-digital converter (A/D) 224.”); ACI-1003, [201]. FIG. 1 from Shelton shows the analog to digital converter 14 (annotated in yellow):



Shelton, FIG. 1 (annotated)

k) Claim 15

Limitation [15.0]

See [8.0] supra.

D. Ground 2B: Claims 3-5 and 11-13 are obvious over Shelton, Henderson and Thomas in view of Carmichael

1. The combination of Shelton, Henderson, Thomas and Carmichael

In the combination, the radar system of the previous Shelton-Henderson-Thomas combination is modified based on the teachings of Carmichael to automatically detect, based on vehicle speed, whether the vehicle is moving or stationary. *See* ACI-1006, claim 9; *see also* [0062]; ACI-1003, [203].

2. Reasons to combine Shelton, Henderson, Thomas and Carmichael

It would have been obvious to a POSITA to modify the previous Shelton-Henderson-Thomas combination to automatically detect, based on vehicle speed, whether the vehicle is moving or stationary, as taught by Carmichael. ACI-1003, [204]. For example, as described by Carmichael, “[f]or ease of operation, it is *desirable* to have the radar device automatically switch over to stationary mode if the patrol vehicle is stopped,” and “likewise, *it is also desirable* to have the radar device to switch back to moving mode once the patrol vehicle is moving again.” ACI-1006, [0062]. A POSITA would have been aware of the desirability of these features based on Carmichael’s disclosure, and thus would have been motivated to incorporate the automatic movement detection of Carmichael into the Shelton-Henderson-Thomas combination. *See id.*; ACI-1003, [204].

Further, a POSITA would have found it obvious to modify the previous Shelton-Henderson-Thomas combination based on Carmichael’s teachings because doing so entails the use of known solutions to improve similar systems and methods in the same way. ACI-1003, [205]. Here, “when a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). A POSITA would have recognized that applying Carmichael’s teachings to augment the Shelton-Henderson-Thomas system would have led to predictable

results without significantly altering or hindering the functions performed by the Shelton-Henderson-Thomas system. ACI-1003, [205].

In fact, a POSITA would have been motivated to incorporate the well-known techniques of Carmichael into the Shelton-Henderson-Thomas system to achieve the predictable benefits described in Carmichael. ACI-1003, [206]; *see, e.g.*, ACI-1006, [0062]. Indeed, a POSITA would have had a reasonable expectation of success incorporating Carmichael's teachings into the Shelton-Henderson-Thomas system, because Carmichael discloses a radar device operating in the proposed manner. *See* ACI-1006, [0062]; ACI-1003, [206].

Accordingly, for at least these reasons, augmenting the Shelton-Henderson-Thomas system based on the teachings of Carmichael would have been routine and straightforward to a POSITA, and it would have been clear that such a combination would predictably work and provide the expected results. *Id.*; ACI-1003, [207].

3. Analysis

a) Claim 11

Limitation [11.0]

In the combination, Carmichael discloses a “radar device” having “a moving mode and a stationary mode,” that “***automatically switch[es] to the stationary mode if the vehicle speed information indicates that the speed of the vehicle is zero and automatically switch[es] to the moving mode if the vehicle speed***

information is not zero.” ACI-1006, claim 9; *see also* [0062]; ACI-1003, [208]. As described above (*see* Section IV.D.2 *supra*), a POSITA would have been motivated to incorporate these features into the prior Shelton-Henderson-Thomas combination. ACI-1003, [208].

As discussed above, in the combination, Henderson further teaches that selection of stationary mode “configures the DSP 202 to accept all return frequencies as absolute Doppler returns, meaning that the target vehicle's speed is directly proportional to the received frequency,” and thus is not based on the patrol speed. ACI-1009, 6:21-25. By contrast, Henderson teaches that “[w]hen the DSP 202 is placed into the moving mode of operation (blocks 87-90, FIG. 25), the patrol vehicle speed must be determined prior to target speed determination because the antenna is also in motion, thus altering the Doppler frequency shifts of any target vehicle return signals.” ACI-1009, 6:55-59. Thus, the patrol speed is used to determine the absolute target speed only in the moving mode. *See id.*, 6:21-25, 6:55-59; ACI-1003, [209].

Accordingly, the Shelton-Henderson-Thomas-Carmichael combination renders this limitation obvious.

b) Claim 12

Limitation [12.0]

As previously discussed, in the combination, Thomas discloses a “controller

10” (*i.e.*, a speed determining element) that “includes a receiver 12 to ***receive a signal from...global positioning satellites.***” ACI-1005, 4:33-5:3. The controller 10 “***calculate[s]***” a “***current-vehicle-speed signal...from GPS (global positioning data).***” *Id.*, 2:8-10; *see also* 7:7-8:1 (“The information available from the GPS system can be used to calculate speed, therefore obviating the need for a separate speed sensor 22 input.”); ACI-1003, [211]. In Thomas’s system, the controller 10 outputs the “current-vehicle-speed signal” to a comparator which compares it to a speed limit signal. ACI-1005, 4:33-5:16; ACI-1003, [211]. Because the current vehicle speed changes with time, Thomas’ controller 10 sends a stream of messages at regular intervals including the current vehicle speed. *See id.*; ACI-1003, [211]. These messages comprise the “current-vehicle-speed signal” described in Thomas. *See id.*

Accordingly, the Shelton-Henderson-Thomas-Carmichael combination renders this limitation obvious.

Limitation [12.1]

As previously discussed, in the combination, Carmichael discloses a “radar device” having “a moving mode and a stationary mode,” that “automatically switch[es] to the stationary mode if the vehicle speed information indicates that the speed of the vehicle is zero and ***automatically switch[es] to the moving mode if the vehicle speed information is not zero.***” ACI-1006, claim 9; *see also* [0062].

Thus, if the patrol vehicle speed is greater than zero (a first threshold) for a pre-determined number of successive messages (*e.g.*, one) the patrol vehicle is determined to be moving. *See id.*; ACI-1003, [213].

Accordingly, the Shelton-Henderson-Thomas-Carmichael combination renders this limitation obvious.

Limitation [12.2]

As previously discussed, in the combination, Carmichael discloses a “radar device” having “a moving mode and a stationary mode,” that “***automatically switch[es] to the stationary mode if the vehicle speed information indicates that the speed of the vehicle is zero*** and automatically switch[es] to the moving mode if the vehicle speed information is not zero.” ACI-1006, claim 9; *see also* [0062]. Thus, if the patrol vehicle speed is zero (*i.e.*, less than a positive second threshold) for a pre-determined number of successive messages (*e.g.*, one) the patrol vehicle is determined to be stationary. *See id.*; ACI-1003, [215].

Accordingly, the Shelton-Henderson-Thomas-Carmichael combination renders this limitation obvious.

c) Claim 13

Limitation [13.0]

See [11.0] *supra*.

d) Claim 3

Limitation [3.0]

See [11.0] supra.

e) Claim 4

Limitation [4.0]

See [12.0], [12.1] supra.

f) Claim 5

Limitation [5.0]

See [12.0], [12.2] supra.

E. Ground 3: Claims 1-15 are obvious over the '039 Publication in view of Jones

1. The '602 Patent is not entitled to its claimed priority date

The '039 Patent (ACI-1014) is part of the priority chain of the '602 Patent. ACI-1001, Face. Specifically, the '602 Patent is continuation of U.S. Patent No. 11,579,314, which is a continuation-in-part of the '039 Patent, which claims priority to three provisional applications, the earliest of which was filed on October 9, 2017. *Id.* But, as described below, the specification of the '039 Patent fails to provide written description support for features included in all claims of the '602 Patent. Due to this lack of written description support in the '039 Patent's specification, the '602 Patent is not entitled to its claimed priority date.

Specifically, if the “radar transceiver” limitation of claims 1 and 9 of the '602 Patent (Limitations [1.1] and [9.1]) is construed to mean that the radar

transceiver must be configured to “transmit and receive radar beams” from both of the front zone or the rear zone (the Second Interpretation discussed at Section III.A.2 *supra*), then the limitation is not supported by the specification of the ’039 Patent. The ’039 Patent specification does not include any description of a “radar transceiver” that is “configured to transmit and receive radar beams” in both “a front zone corresponding to an area in front of a patrol vehicle” or “in a rear zone corresponding to an area behind the patrol vehicle.” ACI-1003, [222]. The ’039 Patent instead describes a “front radar transceiver” configured to transmit and receive radar beams only “in front of the patrol vehicle, also known as the ‘front zone’” and a *separate* “rear radar transceiver” configured to transmit and receive radar beams only “in the rear of the patrol vehicle , also known as the ‘rear zone.’” ACI-1014, 4:13-5:8; *see also* FIG. 2 (showing the separate front and rear transceivers 12 and 14 and the areas covered by each); ACI-1003, [222]. Disclosure of these two separate radar transceivers covering the front and rear zones is insufficient to support claims directed to a single transceiver covering both the front and rear zones under this proposed construction. *See id.*; ACI-1003, [222].

Accordingly, because the ’039 Patent does not support the “radar transceiver” limitation present in all claims of the ’602 Patent, the earliest priority date to which the ’602 Patent is entitled is June 21, 2022—the filing date of the

'602 Patent and the date on which the new matter was added to the application.

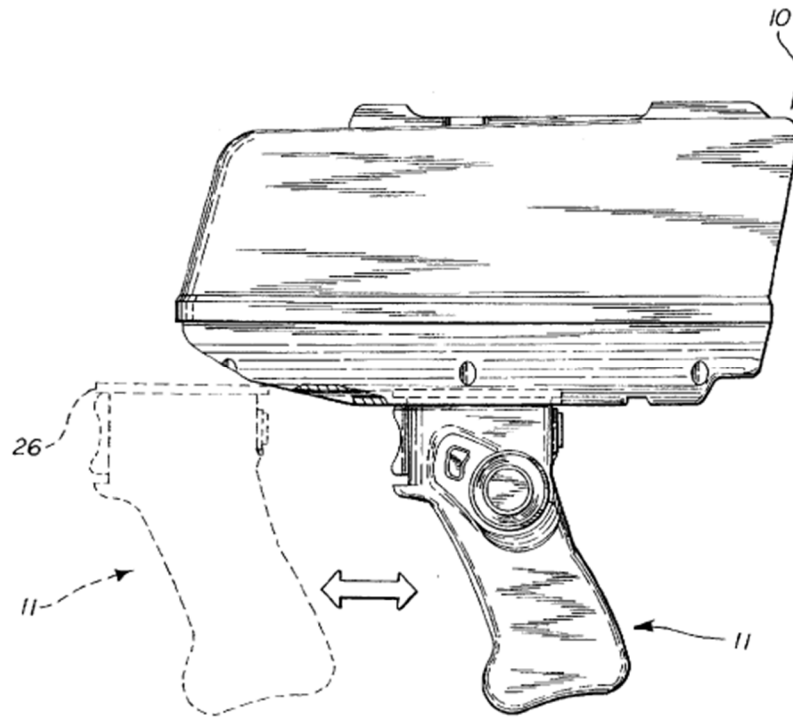
ACI-1001, Face.

2. The '039 Publication qualifies as prior art to the '602 Patent

The '039 Publication (ACI-1015) is the U.S. Patent Publication of the '039 Patent. *See* ACI-1014, Face. Because, as discussed above, the earliest possible priority date of the '602 Patent is March 9, 2021, The '039 Publication qualifies as prior art to the '602 Patent at least because it was published on April 11, 2019, over three years before the earliest possible priority date of the '602 Patent (June 21, 2022). 35 U.S.C. § 102(a)(1); *see* ACI-1015, Face; Section IV.E.1 *supra*.

3. Overview of Jones

Jones describes a “velocity/speed measurement radar unit” that “incorporates a handle assembly for detachment from a base unit to allow for convertibility from a hand-held unit to a remote controlled radar unit.” ACI-1016, Abstract. FIG. 4 from Jones shows the removable handle assembly 11 used with a traffic radar unit 10:



ACI-1016, Detail of FIG. 4

4. The combination of the '039 Publication and Jones

In the combination, the handle assembly of Jones is implemented in the traffic radar system of the '039 Publication such that an operator of the system can aim the radar transceiver towards both the front and the rear of the vehicle, thereby enabling the transceiver to transmit and receive radar beams in both the front and the rear of the vehicle. ACI-1015, [0024], [0026]; ACI-1016, Abstract, 5:65-67; ACI-1003, [226].

5. Reasons to combine '039 Publication and Jones

It would have been obvious to a POSITA to modify '039 Publication to include the removable handle assembly taught by Jones. ACI-1003, [227]. Jones

teaches, and a POSITA would have understood, that it was “desirable for observation instruments, such as...speed measurement or vehicular traffic radar guns...to operate in...a hand-held configuration,” as predictable result enabled by implementing Jones’ removable handle assembly. ACI-1016, 1:12-17; ACI-1003, [227]. Specifically, providing a removable handle assembly using the disclosure of Jones to allow a user to convert a dash-mounted traffic radar to operate in a directional hand-held configuration would provide numerous advantages over the prior art non-directional dash-mounted units, as discussed in Jones, and give the operator of the unit the ability to aim the otherwise fixed unit at targets located in both the front and the rear of the patrol vehicle, thereby increasing the utility of the traffic radar unit by enabling it to measure the speed of a larger range of targets. ACI-1016, 1:12-17, 1:24-2:28; ACI-1003, [227].

Further, a POSITA would have found it obvious to modify the ’039 Publication based on Jones’ teachings to provide the claimed directional transceiver because doing so entails the use of known solutions to improve similar systems and methods in the same way. ACI-1003, [228]. Here, “when a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). A POSITA would have recognized that applying Jones’ teachings

to augment the system of the '039 Publication would have led to predictable results of the claimed directional transceiver without significantly altering or hindering the functions performed by the '039 Publication's system. ACI-1003, [228].

In fact, a POSITA would have been motivated to incorporate the well-known techniques of Jones into the system of the '039 Publication to achieve the predictable benefits of being able to convert a fixed transceiver to a directional transceiver, as described in Jones. ACI-1003, [229]; *see, e.g.*, ACI-1016, Abstract, 1:12-17, 5:65-67, FIG. 4. Indeed, a POSITA would have had a reasonable expectation of success incorporating Jones' teachings into the system of the '039 Publication, because Jones describes a device operating in the proposed manner. *See* ACI-1016, Abstract, 1:12-17, 5:65-67, FIG. 4; ACI-1003, [229].

Accordingly, for at least these reasons, augmenting the '039 Publication's device based on the teachings of Jones would have been routine and straightforward to a POSITA, and it would have been clear that such a combination would predictably work and provide the expected results. *Id.*; ACI-1003, [230].

6. Analysis

a) Claim 9

Limitation [9.0]

The '039 Publication discloses a "traffic radar system." *See, e.g.*, ACI-1015, Abstract, [0004], [0022], FIGS. 1, 2, claims 1, 10; ACI-1003, [231].

Limitation [9.1]

In the combination, the '039 Publication discloses that the “traffic radar system” includes a “*radar transceiver*” that “may be mounted or installed on the forward portion of the patrol vehicle, such as a hood, a grill, or a front bumper of the vehicle,” and that produces a “radar beam” that “is transmitted in front of the patrol vehicle.” ACI-1015, [0024], [0026]; ACI-1003, [232].

Also in the combination, Jones discloses “a handle assembly 11 for attachment to and control of a radar base unit 12 for convertibility from a hand-held to a remote radar system.” ACI-1016, 5:65-67. As described above (*see* Section IV.E.5 *supra*, it would have been obvious to a POSITA to incorporate Jones’ handle assembly into the traffic radar system of the '039 Publication to enable an operator of the system to aim the radar transceiver towards both the front and the rear of the vehicle, thereby enabling the transceiver to transmit and receive radar beams in both the front and the rear of the vehicle. ACI-1003, [233].

Limitation [9.2]

The '039 Publication discloses a “speed determining element...configured to receive and process radio frequency signals from a global navigation satellite system to determine and output a speed of the patrol vehicle.” ACI-1015, [0006], claim 10; ACI-1003, [234].

Limitations [9.3]-[9.11]

The '039 Publication discloses:

[9.3] a processing element configured to [9.4] receive a plurality of digital data samples derived from the first or second electronic signals, [9.5] receive the speed of the patrol vehicle, [9.6] perform a time domain to frequency domain conversion on the digital data samples creating a plurality of frequency bins, each frequency bin associated with a bin number, having a relative magnitude value, and corresponding to a speed of a vehicle, [9.7] identify a range of frequency bin numbers that correspond to the speed of the patrol vehicle and [9.8] form a patrol vehicle speed window, [9.9] determine at least one group of successive frequency bin numbers outside of the patrol vehicle speed window whose relative magnitude is greater than a spike threshold value, [9.10] convert one frequency bin number in each group to the relative speed of one target vehicle, and [9.11] convert the relative speed of the target vehicle to an absolute speed using the speed of the patrol vehicle.

ACI-1015, claim 10 (bracketed numbers added to indicate corresponding limitations); ACI-1003, [236].

b) Claim 10

Claim 11 of the '039 Publication is textually identical to claim 10.

ACI-1015, claim 11; ACI-1003, [237].

c) Claim 11

Claim 12 of the '039 Publication is textually identical to claim 11.

ACI-1015, claim 12; ACI-1003, [238].

d) Claim 12

Claim 13 of the '039 Publication is textually identical to claim 12.

ACI-1015, claim 13; ACI-1003, [239].

e) Claim 13

See [11.0] supra.

f) Claim 14

Claim 14 of the '039 Publication is textually identical to claim 14.

ACI-1015, claim 14; ACI-1003, [241].

g) Claim 1

Limitations [1.0]-[1.11]

See [9.0]-[9.11] supra.

h) Claim 2

Limitations [2.0]-[2.3]

See [10.0]-[10.3] supra.

i) Claim 3

See [11.0] supra.

j) Claim 4

Claim 5 of the '039 Publication is textually identical to claim 4. ACI-1015, claim 5; ACI-1003, [245].

k) Claim 5

Claim 6 of the '039 Publication is textually identical to claim 5. ACI-1015, claim 6; ACI-1003, [246].

l) Claim 6

Claim 7 of the '039 Publication is textually identical to claim 6. ACI-1015, claim 7; ACI-1003, [247].

m) Claim 7

Claim 8 of the '039 Publication is textually identical to claim 7. ACI-1015, claim 9; ACI-1003, [248].

n) Claim 8

Claim 9 of the '039 Publication is textually identical to claim 8. ACI-1015, claim 9; ACI-1003, [249].

o) Claim 15

Claim 15 of the '039 Publication is textually identical to claim 15. ACI-1015, claim 15; ACI-1003, [250].

V. PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION

A. 314(a) – *Fintiv*

Consistent with Congressional intent, the goals of *Fintiv*, and the Interim Guidance issued by Director Vidal on June 21, 2022 (“Director’s Guidance”), Petitioner respectfully asks the Board to reach the merits of the challenges raised in this Petition. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11, 6 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”); ACI-1011, 6-7, 9.

The Director's Guidance states that "[c]onsistent with *Sotera Wireless, Inc.*, the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB." *Director's Guidance*, 3, 7-8 (citing *Sotera v. Masimo*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (precedential as to § II.A)). Petitioner has made such a *Sotera* stipulation with respect to the district court litigation, presented here as ACI-1013. Accordingly, consistent with the *Director's Guidance*, the Board should "not discretionarily deny institution" of the present Petition. *See Director's Guidance*, 3.

B. 314(a) – *General Plastic*

The *General Plastic* factors favor institution under § 314(a). *General Plastic Industrial Co. Ltd. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 (PTAB Sept. 6, 2017) (precedential as to § II.B.4.i). The present Petition is the first IPR challenge to the '602 Patent filed by Petitioner, and thus is not the type of "follow-on petition" addressed by *General Plastic*.

C. 325(d) – *Advanced Bionics*

Advanced Bionics and the *Becton* factors strongly favor institution. *Advanced Bionics LLC v. MED-EL Elektromedizinische Gerate GmbH*, IPR2019-01469 Pap. 6 (PTAB Feb. 13, 2020) ("Advanced Bionics") (precedential); *Becton*,

Dickinson and Co. v. B. Braun Melsungen AG, IPR2017-01586 Pap. 8 (PTAB Dec. 15, 2017) (“Becton”) (precedential).

Under the *Advanced Bionics* framework, discretionary denial under Section 325(d) is appropriate only if a condition in the framework’s first prong is satisfied, and if there is no showing of material error under the second prong. *See Advanced Bionics*, 8-10. As stated in *Advanced Bionics*, those two prongs are:

(1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of [the] first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

Advanced Bionics, 8-10.

Neither of the conditions in the first prong are satisfied here. The Aker, Aker ’724, Shelton, Henderson, Thomas, and Carmichael references were similarly not cited by the Examiner. *See* ACI-1001, Face.⁴ These references are all new, noncumulative prior art. Thus, neither the same or substantially the same art or arguments were previously presented to the Office during prosecution.

⁴ The Aker ’642 reference (ACI-1010) is not included in any Ground in the present Petition, and is used only as corroborating evidence.

Accordingly, because the first prong of *Advanced Bionics* is not satisfied, discretionary denial under Section 325(d) is not appropriate.

For at least these reasons, Petitioner respectfully requests institution of the instant Petition.

VI. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Parties-In-Interest Under 37 C.F.R. §42.8(b)(1)

Petitioner Applied Concepts Inc. is the real party-in-interest.

B. Related Matters Under 37 C.F.R. §42.8(b)(2)

Petitioner is not aware of any disclaimers, reexamination certificates, or petitions for *inter partes* review for the '602 Patent.

The '602 Patent is asserted by Patent Owner in *Kustom Signals Inc. v. Applied Concepts Inc.*, Case No. 3:23-cv-01937-N, which is currently pending in the Northern District of Texas.

C. Lead And Back-Up Counsel Under 37 C.F.R. §42.8(b)(3)

Lead Counsel
Daniel D. Smith U.S. Reg. No. 71,278 2323 Ross Ave., Suite 600, Dallas, TX 75201 Tel: 214-953-6140 Email: ddsmith@jw.com
Backup Counsel
Christopher J. Rourk U.S. Reg. No. 39,348 2323 Ross Ave., Suite 600, Dallas, TX 75201 Tel: 214-953-5990 Email: crourk@jw.com
Wasif Qureshi U.S. Reg. No. 51,048 1401 McKinney St., Suite 1900, Houston, TX 77010 Tel: 713-752-4521 Email: wqureshi@jw.com

D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service via email including all of the following addresses: ddsmith@jw.com, crourk@jw.com, wqureshi@jw.com, and pcollins@jw.com.

VII. PAYMENT OF FEES – 37 C.F.R. §42.103

Petitioner authorizes the Office to charge Deposit Account No. 10-0096 for the petition fee set in 37 C.F.R. §42.15(a) and for any other required fees.

VIII. CONCLUSION

Accordingly, Petitioner respectfully requests IPR of the Challenged Claims.

Respectfully submitted,

Dated: May 1, 2024

/Daniel D. Smith/

Daniel D. Smith, Reg. No. 71,278
Christopher J. Rourk, Reg. No. 39,348
Wasif Qureshi, Reg. No. 51,048
2323 Ross Ave. Suite 600
Dallas, TX 75201
Tel: 214-953-6140
Fax: 214-953-5822

(Control No. IPR2024-00884)

Attorneys for Petitioner

CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,964 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: May 1, 2024

/Daniel D. Smith/

Daniel D. Smith, Reg. No. 71,278
Christopher J. Rourk, Reg. No. 39,348
Wasif Qureshi, Reg. No. 51,048
2323 Ross Ave. Suite 600
Dallas, TX 75201
Tel: 214-953-6140
Fax: 214-953-5822

Attorneys for Petitioner

CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on May 1, 2024, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided to the following counsel of record for Patent Owner by overnight delivery via Federal Express:

Scott Brown
Matt Walters
Todd Gangel
Hovey Williams LLP
10801 Mastin Blvd., Suite 1000
84 Corporate Woods
Overland Park, Kansas 66210

/Pam Collins/
Pam Collins
2323 Ross Ave., Suite 600,
Dallas, TX 75201
Tel: 214-953-5973