

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
3 April 2008 (03.04.2008)

PCT

(10) International Publication Number  
WO 2008/039948 A3

- (51) International Patent Classification:  

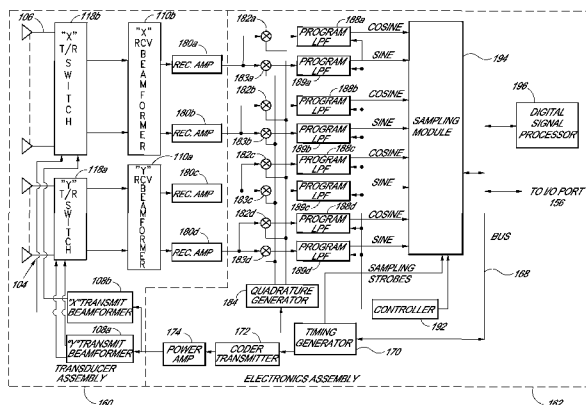
G01P 5/24 (2006.01)	G01S 15/60 (2006.01)
G01S 15/58 (2006.01)	G01S 15/89 (2006.01)
- (74) Agent: MALLON, Joseph, J.; Knobbe Martens Olson & Bear LLP, 2040 Main Street, 14th Floor, Irvine, CA 92614 (US).
- (21) International Application Number:  
PCT/US2007/079782
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (22) International Filing Date:  
27 September 2007 (27.09.2007)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  

11/540,997	28 September 2006 (28.09.2006)	US
11/540,304	28 September 2006 (28.09.2006)	US
11/529,786	28 September 2006 (28.09.2006)	US
- (71) Applicant (for all designated States except US): TELE-DYNE RD INSTRUMENTS, INC. [US/US]; 14020 Stowe Drive, Poway, CA 92064 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): VOGT, Mark, A. [US/US]; 11373 Vista Elevada, San Diego, CA 92131 (US). BRUMLEY, Blair, H. [US/US]; 3151 Morning Way, La Jolla, CA 92037 (US). ROWE, Fran [US/US]; 5723 Lodi Street, San Diego, CA 92117 (US).
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:  
— with international search report

[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR ACOUSTIC DOPPLER VELOCITY PROCESSING WITH A PHASED ARRAY TRANSDUCER



(57) Abstract: Systems and methods for measuring velocity in fluid are disclosed. In one aspect, a method (900) comprises transmitting a first set of signals of a bandwidth broader than the measuring system, receiving echoes from the first set of signals, obtaining a first velocity estimate based on the echoes, transmitting a second set of signals of a bandwidth narrower than the measuring system, receiving echoes from the second set of signals, obtaining velocity estimates based on the echoes from the second set of signals, selecting one of the velocity estimates based on the first velocity estimate. In another aspect, a method (280) comprises removing substantially a bias related to a first velocity from raw velocity estimates. In another aspect, a method (1900) comprises obtaining a velocity estimate for each of a set of transmitted pings, calculating a velocity based on the sum of the velocity estimates.

WO 2008/039948 A3



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

**(88) Date of publication of the international search report:**  
7 May 2009

## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2007/079782

A. CLASSIFICATION OF SUBJECT MATTER  
 INV. G01P5/24 G01S15/58 G01S15/60 G01S15/89

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G01P G01S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 615 173 A (BRUMLEY BLAIR H [US] ET AL) 25 March 1997 (1997-03-25) cited in the application	21-44
A	the whole document	1-20
X	US 5 923 281 A (VOPAT RAYMOND W. [US]) 13 July 1999 (1999-07-13) column 1, line 6 - column 2, line 54 column 3, line 37 - column 4, line 54 figures 3A, 3B, 4A, 4B	21-31
X	US 3 603 920 A (STEDTNITZ WOLFGANG RICHARD ERN) 7 September 1971 (1971-09-07) column 1, line 6 - column 2, line 4 column 3, line 3 - column 8, line 41 figures 1a, 1b, 2-6	21-26, 29-44
	-/--	

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

5 March 2009

Date of mailing of the international search report

20/03/2009

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040,  
 Fax: (+31-70) 340-3016

Authorized officer

Reto, Davide

## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2007/079782

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98/15846 A (ROWE DEINES INSTR INC [US]) 16 April 1998 (1998-04-16) cited in the application the whole document -----	1-44
A	US 5 381 384 A (WINJE ROBERT L [US]) 10 January 1995 (1995-01-10) column 2, line 24 - column 3, line 63 figures 1,2 -----	1-20
A	LEE ET AL: "Golay Codes for Simultaneous Multi-Mode Operation in Phased Arrays" PROCEEDINGS OF THE ULTRASONICS SYMPOSIUM. SAN DIEGO, OCT. 27 - 29, 1982; [PROCEEDINGS OF THE ULTRASONICS SYMPOSIUM], NEW YORK, IEEE, US, vol. 2, no. 2, 27 October 1982 (1982-10-27), pages 821-825, XP002117286 the whole document -----	32-44

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2007/079782

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this international search reportcovers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-20

Method (and corresponding device) of measuring velocity in a fluid medium including the transmission of a first and second set of signals and the reception of the corresponding echoes.

---

2. claims: 21-31

Method (and corresponding device) of measuring velocity in a fluid medium including the reception of echoes of a plurality of beams.

---

3. claims: 32-44

Method (and corresponding device) of measuring velocity in a fluid medium including the transmission of an acoustic signal comprising N pings.

---

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2007/079782

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5615173	A	25-03-1997	NONE
US 5923281	A	13-07-1999	US 6072425 A 06-06-2000
US 3603920	A	07-09-1971	DE 1798276 B1 27-04-1972 FR 2019462 A5 03-07-1970 GB 1274054 A 10-05-1972 JP 48022218 B 04-07-1973 NL 6914243 A 23-03-1970 NO 129483 B 16-04-1974
WO 9815846	A	16-04-1998	AT 236409 T 15-04-2003 DE 69720483 D1 08-05-2003 DE 69720483 T2 24-12-2003 EP 0929825 A1 21-07-1999 JP 3995270 B2 24-10-2007 JP 2001502058 T 13-02-2001 JP 4087430 B2 21-05-2008 JP 2007192830 A 02-08-2007 NO 991555 A 04-06-1999 US 5808967 A 15-09-1998
US 5381384	A	10-01-1995	NONE