



(51) International Patent Classification:

B64C 39/02 (2006.01) *B64C 27/08* (2006.01)
B64D 43/00 (2006.01) *G01C 21/20* (2006.01)
B64D 45/00 (2006.01)

(21) International Application Number:

PCT/US2016/024347

(22) International Filing Date:

25 March 2016 (25.03.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/139,625 27 March 2015 (27.03.2015) US

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(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, 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, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on next page]

(54) Title: UNMANNED AIRCRAFT NAVIGATION SYSTEM AND METHOD

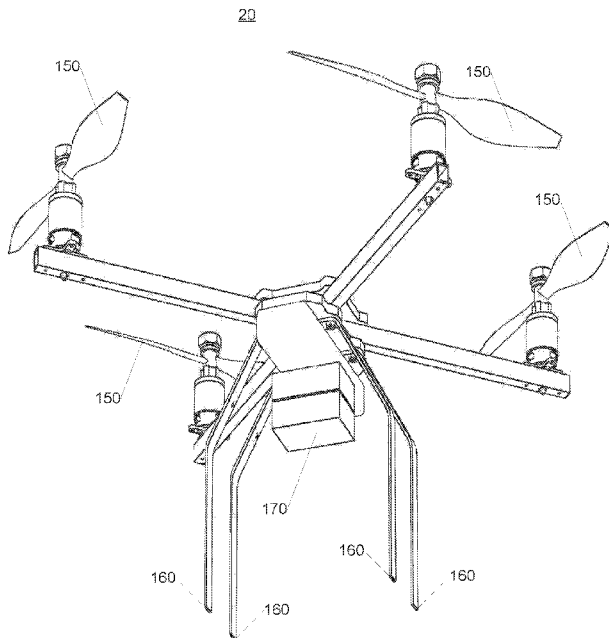
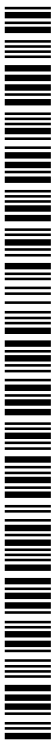


FIG. 2B

(57) Abstract: Systems, apparatuses and methods for landing
an unmanned aircraft on a mobile structure are presented.
Sensors on the aircraft identify a predetermined landing area
on a mobile structure. The aircraft monitors the sensor data to
maintain its position hovering over the landing area. The air-
craft estimates a future attitude of the surface of the landing
area and determines a landing time that corresponds to a de-
sired attitude of the surface of the landing area. The un-
manned aircraft executes a landing maneuver to bring the air-
craft into contact with the surface of the landing area at the
determined landing time.





SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))*

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:

9 February 2017

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/024347**A. CLASSIFICATION OF SUBJECT MATTER****B64C 39/02(2006.01)i, B64D 43/00(2006.01)i, B64D 45/00(2006.01)i, B64C 27/08(2006.01)i, G01C 21/20(2006.01)i**

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)

B64C 39/02; G01S 7/02; G01C 23/00; G01S 13/91; G08G 5/04; G06F 17/00; B64C 19/00; B64D 47/08; B64D 43/00; B64D 45/00; B64C 27/08; G01C 21/20

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

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: unmanned aircraft, mobile landing area, landing time, quiescent period, sensor, navigation

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006-0058928 A1 (BEARD et al.) 16 March 2006 See paragraphs [0002], [0021]-[0070]; and figures 1-3.	1-23, 27-35, 39-41
Y		24-26, 36-38
Y	US 2014-0222246 A1 (MOHAMADI, FARROKH) 07 August 2014 See paragraphs [0064]-[0071]; and figures 9A-9B.	24-26, 36-38
A	US 2014-0236390 A1 (MOHAMADI, FARROKH) 21 August 2014 See paragraphs [0017]-[0035]; and figure 2.	1-41
A	US 2014-0324253 A1 (L-3 UNMANNED SYSTEMS, INC.) 30 October 2014 See paragraphs [0048]-[0065]; and figure 1.	1-41
A	WO 2006-132713 A2 (SIKORSKY AIRCRAFT CORPORATION) 14 December 2006 See paragraphs [0033]-[0048]; and figure 1.	1-41

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search

10 January 2017 (10.01.2017)

Date of mailing of the international search report

10 January 2017 (10.01.2017)

Name and mailing address of the ISA/KR

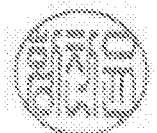
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/024347

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-0058928 A1	16/03/2006	US 7302316 B2	27/11/2007
US 2014-0222246 A1	07/08/2014	US 9110168 B2	18/08/2015
US 2014-0236390 A1	21/08/2014	US 8880241 B2	04/11/2014
US 2014-0324253 A1	30/10/2014	US 2005-0004723 A1	06/01/2005
		US 2009-0125163 A1	14/05/2009
		US 2010-0292873 A1	18/11/2010
		US 2010-0292874 A1	18/11/2010
		US 2011-0130913 A1	02/06/2011
		US 2011-0184590 A1	28/07/2011
		US 2012-0123628 A1	17/05/2012
		US 2013-0345920 A1	26/12/2013
		US 7343232 B2	11/03/2008
		US 7693624 B2	06/04/2010
		US 8068949 B2	29/11/2011
		US 8068950 B2	29/11/2011
		US 8082074 B2	20/12/2011
		US 8103398 B2	24/01/2012
		US 8355834 B2	15/01/2013
		US 8768555 B2	01/07/2014
		US 9108729 B2	18/08/2015
WO 2006-132713 A2	14/12/2006	EP 1882157 A2	30/01/2008
		EP 1882157 A4	01/08/2012
		US 2004-0217883 A1	04/11/2004
		US 2005-0237226 A1	27/10/2005
		US 2006-0238377 A1	26/10/2006
		US 7091881 B2	15/08/2006
		US 7106217 B2	12/09/2006
		WO 2006-132713 A3	22/03/2007