



# Express Search

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Mr. Express Search Internal  
Express Search, Inc  
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Re:  
Patent Landscape Search  
Unmanned Air Vehicles  
Express Search Sample Landscape Search

July 10, 2019

Dear Mr. Search,

In accordance with your e-mail received on September 23, 2019, a Patent Landscape Search was conducted for unmanned air vehicles.

We searched the current patent landscape covering unmanned air vehicles for a variety of situations. These features and characteristics are meant to give a broad coverage of the technology.

## Navigation

GPS - and (GPS geoposition <near/4> satellite)  
Celestial - and (astrolabe sextant octant navigation <near/9> (celestial astral sighting stellar))  
Geographical - and ((terrain following) (navigation <near/9> (terrain landmark map geography))) Autonomous - and ((navigation guide steer) <near/19> (independent autonomous))  
Radio-Control - and (control <near/19> (radio, wireless))

## Payload

Communications - and (aerostat or (communication <near/19> (repeater relay broadcast)))  
Sensors - and ((sensor detector transducer) <near/19> (surveillance spy intelligence (FLIR RADAR LIDAR)))  
ELINT - and ((electronic intelligence) ELINT (signal intelligence) SIGINT))

Weaponry - and (armament missile weaponry offensive attack munitions)

Cargo - and (payload (cargo <near> freight provisions))

## Power

Fuel - Fuel (liquids - conventional exotic and Solid)

Battery - Propulsion power necessitating a battery

Solar - and ((electric power) (solar photovoltaic photocell))

## Propulsion and Lift

Jet - and ((power propulsion) <near/10> (jet turbojet))

Rocket - and (((power, propulsion) <near/10> (rocket, RATO, (solid fuel))) DESCRIPTION)

Propeller - and ((power, propulsion) <near/10> (propeller, airscrew, (airscrew)) DESCRIPTION)

Fixed Wing - and ((fixed wing) (swing wing) (high wing) (single dual) <near> wing canard (delta wing))

Rotary - and ((rotary wing) helicopter heliocopter rotor gyrocopter autogyro)

Lighter than Air - and (airship (air ship) gasbag (gas bag) helium hydrogen dirigible blimp zeppelin balloon inflate)

The search was conducted in accordance with the disclosure provided.

The following U.S. references for 'Unmanned Air Vehicles' were cited in the search:

9,097,527 [Notstrand et al]

7,980,510 [Tanabe et al]

7,937,878 [Sammut et al]

7,793,888 [Padan]

7,745,767 [Bredy]

7,583,769 [Twitchell et al]

7,574,168 [Twitchell et al]

7,562,843 [Lipponen]

7,487,641 [Frechette et al]

7,447,591 [Belenkii et al]

7,415,313 [Brueckner et al]

7,349,804 [Belenkii et al]

7,327,245 [Krumm et al]

7,264,202 [Sullivan]

7,249,733 [Palmer]

7,224,082 [Bouiller et al]

7,204,455 [Sinclair]

7,168,533 [Podratzky]

7,127,334 [Frink]

7,089,000 [Chang et al]

7,066,430 [Dennis et al]

7,055,777 [Colting]

8,123,162 [Sirkis]

7,976,310 [Bachelder et al]

7,862,045 [Hodge]

7,783,246 [Twitchell et al]

7,708,493 [Jung et al]

7,581,696 [Morgan et al]

7,566,177 [Thompson]

7,561,881 [Feher]

7,475,549 [Alexander et al]

7,440,826 [Franceschini et al]

7,397,357 [Krumm et al]

7,338,010 [Corder et al]

7,299,069 [Claussen]

7,262,395 [Bilyk et al]

7,240,878 [Towne]

7,219,490 [Dev]

7,195,200 [Yamane]

7,152,347 [Herzog et al]

7,105,790 [Lamorlette]

7,083,148 [Bajuyo et al]

7,066,427 [Chang]

7,055,306 [Jones et al]

8,030,567 [Ludwig]

7,953,372 [Ofek et al]

7,860,680 [Arms et al]

7,752,976 [Banks]

7,640,723 [Alexander]

7,574,300 [Twitchell et al]

7,564,408 [Glockler et al]

7,542,828 [Steele et al]

7,464,895 [Palmer]

7,436,038 [Engelmann et al]

7,372,175 [Bouiller et al]

7,331,019 [Ananth et al]

7,269,513 [Herwitz]

7,261,257 [Helou]

7,234,667 [Talmage]

7,207,566 [Hodge]

7,194,866 [Jones et al]

7,149,611 [Beck et al]

7,095,488 [Jamieson et al]

7,082,706 [Stinis et al]

7,059,566 [Byers et al]

7,050,813 [Paiz]

7,047,861	[Solomon]
7,023,375	[Klausing et al]
6,988,357	[Dev]
6,965,816	[Walker]
6,943,701	[Zeineh]
6,907,326	[Kucik]
6,879,878	[Glenn et al]
6,867,728	[Hanna et al]
6,840,480	[Carroll]
6,832,251	[Gelvin et al]
6,798,357	[Khan]
6,732,974	[Lewis et al]
6,672,534	[Harding et al]
6,648,272	[Kothmann]
6,628,231	[Mayersak]
6,615,165	[Carroll]
6,584,879	[Gorman]
6,549,130	[Joao]
6,540,179	[Henderson]
6,487,500	[Lemelson et al]
6,471,160	[Grieser]
6,431,494	[Kinkead et al]
6,416,019	[Hilliard et al]
6,392,313	[Epstein et al]
6,382,556	[Pham]
6,338,457	[Hilliard et al]
6,293,202	[Woodall et al]
6,275,773	[Lemelson et al]
6,211,816	[Westphal]
6,170,778	[Cycon et al]
6,116,606	[Brum et al]
6,082,675	[Woodall et al]
6,056,237	[Woodland]
5,983,161	[Lemelson et al]
5,906,336	[Eckstein]
5,850,617	[Libby]
5,785,281	[Peter et al]
5,713,536	[Bata]
5,655,945	[Jani]
5,584,047	[Tuck]
5,524,524	[Richards et al]
5,425,281	[McFall]
5,340,056	[Guelman et al]
5,245,927	[Ranes]
5,140,820	[Booz]
5,082,204	[Croston]
5,005,009	[Roberts]
4,935,742	[Marin]
4,907,764	[Long]
4,818,990	[Fernandes]
4,783,799	[Maass]
7,047,425	[Dubuque]
7,007,889	[Charron]
6,966,523	[Colting]
6,965,342	[Klausing et al]
6,923,404	[Liu et al]
6,899,298	[Lee]
6,874,729	[McDonnell]
6,847,865	[Carroll]
6,839,017	[Dillman]
6,819,291	[Lackey et al]
6,789,768	[Kalisch]
6,726,148	[Carroll]
6,670,920	[Herrick]
6,647,328	[Walker]
6,621,456	[Ryken et al]
6,604,711	[Stevens et al]
6,564,146	[Meyer et al]
6,542,077	[Joao]
6,530,543	[Redding et al]
6,478,262	[Kinkead et al]
6,466,172	[Ryken et al]
6,422,508	[Barnes]
6,409,122	[Nicolai]
6,388,611	[Dillman]
6,380,889	[Herrmann et al]
6,333,726	[Bettinger]
6,286,410	[Leibolt]
6,270,038	[Cycon et al]
6,193,188	[Ahmad et al]
6,164,591	[Descatha]
6,094,163	[Chang]
6,065,718	[Piasecki]
6,037,899	[Weber]
5,932,940	[Epstein et al]
5,880,693	[Drummer]
5,847,679	[Yee et al]
5,740,987	[Morris et al]
5,695,153	[Britton et al]
5,620,153	[Ginsberg]
5,581,250	[Khvilivitzky]
5,516,060	[McDonnell]
5,398,032	[Tucker et al]
5,308,022	[Cronkhite et al]
5,208,757	[Appriou et al]
5,120,006	[Hadzicki]
5,076,516	[Wheat et al]
4,992,999	[Yerby et al]
4,913,376	[Black]
4,865,328	[Attinello et al]
4,802,639	[Hardy et al]
4,757,481	[Orr et al]
7,040,082	[Bouiller et al]
6,997,097	[Harding]
6,966,174	[Paul]
6,948,681	[Stupakis]
6,914,344	[Franchet et al]
6,886,776	[Wagner et al]
6,871,816	[Nugent et al]
6,842,674	[Solomon]
6,834,835	[Knowles et al]
6,802,237	[Jones et al]
6,744,397	[Hager et al]
6,705,568	[Lee]
6,659,065	[Renegar]
6,628,941	[Knoblauch et al]
6,618,017	[Ryken et al]
6,592,071	[Kinkead et al]
6,549,168	[Ryken et al]
6,542,076	[Joao]
6,498,767	[Carreiro]
6,474,603	[Kinkead et al]
6,455,828	[Gauggel et al]
6,422,506	[Colby]
6,400,996	[Hoffberg et al]
6,385,434	[Chuprun et al]
6,339,396	[Mayersak]
6,326,904	[Parent et al]
6,281,970	[Williams et al]
6,257,527	[Redding et al]
6,190,484	[Appa]
6,158,691	[Menne et al]
6,084,510	[Lemelson et al]
6,061,017	[Vaccaro et al]
6,011,510	[Yee et al]
5,927,648	[Woodland]
5,878,981	[Dewey]
5,799,900	[McDonnell]
5,728,965	[Fesland et al]
5,675,104	[Schorr et al]
5,614,910	[Bradley et al]
5,534,873	[Weichman et al]
5,494,240	[Waugh]
5,388,783	[Lynn]
5,266,799	[Steinitz et al]
5,181,039	[Oswald et al]
5,115,996	[Moller]
5,046,685	[Bose]
4,937,522	[Gee]
4,908,705	[Wight]
4,854,824	[Scholz]
4,786,008	[Corbett]
4,736,583	[Hudema et al]

4,730,793 [Thurber et al]	4,712,371 [Weber]	4,700,307 [Mons et al]
4,690,062 [Bugiel]	4,666,105 [Dellinger et al]	4,643,374 [Friederich]
4,553,718 [Pinson]	4,530,476 [Thurber et al]	4,471,923 [Hoppner et al]
4,445,652 [Engelke et al]	4,428,583 [Feagle]	4,410,151 [Hoppner et al]
4,385,354 [Hornfeld et al]	4,357,777 [Kulik]	4,354,419 [Patterson]
4,309,773 [Johnson et al]	4,308,015 [Tye]	4,296,894 [Schnable et al]
4,289,287 [Child et al]	4,267,562 [Raimondi]	4,262,596 [Allier et al]
4,248,394 [Klumpp]	4,233,605 [Coleman]	4,215,347 [Jarrell et al]
4,205,811 [Palm et al]	4,203,160 [Doherty]	4,200,287 [Ryan et al]
4,094,143 [Schlegel et al]	4,034,372 [Margerum]	4,021,007 [Coxe]
4,005,818 [Krause et al]	3,957,230 [Boucher et al]	3,946,555 [Goede]
3,943,357 [Culver]	3,937,013 [Aspinwall]	3,900,198 [Conner]
3,897,151 [Lecroy]	3,891,165 [Day et al]	3,838,835 [Kling]
3,823,901 [Holmes et al]	3,798,795 [Michelsen]	3,794,273 [Girard]
3,792,827 [Girard]	3,780,970 [Pinnell]	3,778,007 [Kearney et al]
3,746,280 [Coxe et al]	3,739,378 [Botzum et al]	3,737,119 [Cheng]
3,712,226 [Moskowitz et al]	3,703,998 [Girard]	3,678,692 [Heise]
3,623,726 [Pittinger et al]	D 277,976 [Holloway et al]	re35,172 [Clark]
h1,742 [Richmond]	h1,469 [Simonoff]	

2007/0151493 [Graf et al]	2007/0136763 [Stroughter et al]	2007/0087695 [Cohen et al]
2007/0034749 [Wagner]	2007/0023570 [Bernard]	2006/0271251 [Hopkins]
2006/0225599 [Brunet et al]	2006/0221328 [Rouly]	2006/0219094 [Padan]
2006/0206246 [Walker]	2006/0176169 [Doolin et al]	2006/0167601 [Henning et al]
2006/0150612 [Anderson et al]	2006/0144994 [Spirov et al]	2005/0281999 [Hofmann et al]
2005/0211827 [Barocela]	2005/0200480 [Caras et al]	2005/0195096 [Ward et al]
2005/0187677 [Walker]	2005/0166785 [Schramek et al]	2005/0151001 [Loper]
2005/0139363 [Thomas]	2005/0132104 [Brown]	2005/0127242 [Rivers]
2005/0124234 [Sells et al]	2005/0051667 [Arlton et al]	2005/0011348 [Bertrand et al]
2005/0007450 [Hill et al]	2004/0219491 [Shlomo]	2004/0143602 [Ruiz et al]
2004/0134337 [Solomon]	2004/0134336 [Solomon]	2004/0068416 [Solomon]
2004/0068415 [Solomon]	2004/0068351 [Solomon]	2004/0031880 [Stemme et al]
2004/0030571 [Solomon]	2004/0030570 [Solomon]	2004/0030450 [Solomon]
2004/0030448 [Solomon]	2004/0021040 [Redding et al]	2003/0192304 [Paul]
2003/0192303 [Paul]	2003/0152145 [Kawakita]	2003/0136875 [Pauchard]
2003/0136874 [Gjerdrum]	2003/0024453 [Fonda]	2002/0088898 [Lucy]
2002/0088364 [Feldman]	2001/0021365 [Keith]	

The following foreign references for 'Unmanned Air Vehicles' were also noted of interest:

WO 07065781A1 [N/A]	WO 07022177A2 [N/A]
WO 06132703A2 [N/A]	WO 06093612A1 [N/A]
WO 06083368A2 [N/A]	WO 06083320A2 [N/A]
WO 06077315A1 [N/A]	WO 06076647A2 [N/A]
WO 06066561A1 [N/A]	WO 06025986A2 [N/A]
WO 06022654A1 [N/A]	WO 06006151A1 [N/A]
WO 06001856A2 [N/A]	WO 05081012A1 [N/A]
WO 05056378A2 [N/A]	WO 05048086A2 [N/A]

WO 05047805A2 [N/A]  
WO 05039151A2 [N/A]  
WO 05005250A2 [N/A]  
WO 04113166A1 [N/A]  
WO 04101357A2 [N/A]  
WO 04063008A2 [N/A]  
WO 04024562A1 [N/A]  
WO 04003680A2 [N/A]  
WO 03076266A2 [Lee]  
WO 03036323A1 [Unterreiner et al]  
WO 02075235A2 [Kalisch]  
WO 9858273A1 [Yee et al]  
WO 9802350A1 [McDonnell]  
WO 9724260A2 [Cotton et al]  
WO 9612928A1 [Richards et al]  
WO 8902393A1 [Zuck]  
WO 8806738A1 [Samarai]  
WO 0101710A1 [Knoblauch et al]  
WO 0054433A1 [Henderson]  
EP 1806808A2 [Kaplan et al]  
EP 1734333A1 [Brunet et al]  
EP 1666356A1 [Tanabe et al]  
EP 1638220A2 [Knoblauch et al]  
EP 1557356A1 [Perlo et al]  
EP 1480000A1 [Lamorlette]  
EP 1407965A1 [Yamane]  
EP 1197099B1 [Knoblauch et al]  
EP 1090263B1 [Gauggel et al]  
EP 0687626B1 [Ernoult et al]  
EP 0273653B1 [Garside]  
DE 102005014949A1 [N/A]

WO 05047803A1 [N/A]  
WO 05016749A1 [N/A]  
WO 05001409A2 [N/A]  
WO 04110860A1 [N/A]  
WO 04092567A2 [N/A]  
WO 04042315A2 [N/A]  
WO 04018158A2 [N/A]  
WO 04000642A1 [N/A]  
WO 03040653A1 [Burns]  
WO 03004122A1 [N/A]  
WO 9965768A1 [Jeney]  
WO 9825412A1 [Tuck]  
WO 9735433A1 [Zurgil]  
WO 9638340A1 [Bata]  
WO 9408677A1 [Jani]  
WO 8808544A1 [Chisholm]  
WO 0107318A1 [McDonnell]  
WO 0064736A1 [Cycon et al]  
WO 0033012A2 [Ahmad et al]  
EP 1780387A2 [Dev]  
EP 1719969A1 [Bredy]  
EP 1645505A2 [Yamane]  
EP 1557356B1 [Perlo et al]  
EP 1538074A1 [Sells et al]  
EP 1444130B1 [Schafroth]  
EP 1382817B1 [Bouiller et al]  
EP 1196732B1 [Kalisch]  
EP 0762074A1 [Barnier]  
EP 0293173B1 [Roberts et al]  
EP 0187900B1 [Lindstaedt et al]

These patents are representative of the references searched. Copies of the cited references are enclosed for your further review. For additional information on the cited references, please see the patent family, located on the CD results, for related patents and the legal status of cited patents. Please do not hesitate to contact me with any questions regarding this search.

Best Regards,  
EXPRESS SEARCH



Cristopher H. Flagg  
President

CHF

Enclosure: References for 'Unmanned Air Vehicles' – 402 Patents  
Ref: E00-40005