

# Makani Patent Non-Assertion Pledge

Makani Technologies LLC (“Makani”) is committed to promoting the advancement of clean, affordable wind power. In support of this commitment, Makani pledges the free use of the 400+ patents and applications listed on the following pages (“Makani Patents”), which make up its worldwide patent portfolio.

Makani hereby pledges to each person or entity (a “Recipient”) that Makani will not bring a lawsuit or other legal proceeding against a Recipient for patent infringement under any of the Makani Patents (the “Pledge”). It is Makani’s intent that this Pledge be legally binding, irrevocable and enforceable against Makani and its successors and assigns, and in each case limited to the specifically listed Makani Patents only. Thus, Makani will require any person or entity to whom it transfers any of the Makani Patents to agree, in writing, to abide by the Pledge and to place a similar requirement on any subsequent transferees to do the same.

The Pledge is not an assurance that any of the Makani Patents cover any particular technology or are enforceable, that any activities covered by the Pledge will not infringe patents or other intellectual property rights of a third party, or that Makani will add any other patents to the list of Makani Patents. Except as expressly stated in the Pledge, no other rights are waived or granted by Makani, Alphabet Inc. or any of their respective affiliates, or received by a Recipient, whether by implication, estoppel, or otherwise.

# Makani Patents

## Methods and Systems for Transitioning an Aerial Vehicle Between Hover Flight and Crosswind Flight

AU	2014318437
BR	1120160057520
CN	ZL201480050964.5
DE	602014048808
EP	3046835
ES	3046835
FR	3046835
GB	3046835
IE	3046835
IN	201647008320
JP	6293904
KR	10-1680687
NO	3046835
PT	3046835
US	9,126,682
US	9,637,231
US	9,994,314
US	15/989,173
WO	PCT/US2014/055697

## Methods and Systems for Transitioning an Aerial Vehicle Between Crosswind Flight and Hover Flight

AU	2014318448
AU	2016277585
AU	2019222832
AU	2014374087
AU	2017202978
AU	2018286597
BR	1120160058038
BR	1120160150066
CN	ZL 201480050968.3
CN	ZL 201480071897.5
CN	1910032182
DE	3046836
DE	602014041569
EP	3046836
EP	19164170.3
EP	19203253
EP	3089911
EP	18205577.2
ES	3046836
ES	3089911
FR	3046836
FR	3089911
GB	3046836
GB	3089911
IE	3046836
IE	3089911
IN	201647008340
IN	201948047349
IN	201647021672
JP	6093099
JP	6293939
JP	6582072
JP	JP2019-159454

## **Methods and Systems for Transitioning an Aerial Vehicle Between Crosswind Flight and Hover Flight (cont.)**

JP	6243532
JP	6423943
JP	2018-197247
KR	10-2016-7006848
KR	10-1690676
KR	10-2016-7035849
NO	3046836
NO	3089911
PT	3046836
PT	3089911
US	9,126,675
US	9,174,732
US	9,169,013
WO	PCT/US2014/072008
WO	PCT/US2014/055714

## **Tension Member Fatigue Tester Using Transverse Resonance**

US	61/867,917
US	9,372,137
US	9557255

## **Ground Station with Shuttled Drum for Tethered Aerial Vehicles**

US	61/913,860
US	9,676,496
US	PCT/US2014/069094

## **Airfoil for a Flying Wind Turbine**

US	9,709,026
----	-----------

## **Systems and Apparatus for Tether Termination Mount for Tethered Aerial Vehicles**

CN	201480075178
US	61/914,320
US	9,211,951
US	9,216,824
WO	PCT/US2014/069146

## **Extruded Drum Surface for Storage of Tether**

CN	201480070892
US	9,212,032
US	9,212,033
WO	PCT/US2014/070100

## **Electrically-Isolated and Liquid-Cooled Rotor and Stator Assemblies**

US	9,325,224
----	-----------

## **Wiring Harness for an Aerial Vehicle**

AU	2014374074
BR	1120160154339
CN	ZL 201480068115.2
EP	14875921
IN	201647021570
JP	6215491
KR	10-1893665
US	9,205,920
US	9,828,091
WO	PCT/US2014/071902

## Methods and Systems for Winding a Tether

AU	2014370035
CN	ZL201480076584.9
EP	14875457.5
US	9,352,930
WO	PCT/US2014/071907

## Control Methods and Systems for Motors and Generators Operating in a Stacked Configuration

AU	2014365770
AU	2017203933
BR	1120160140923
CN	ZL 201480075781.9
DE	DE602014037172.8
EP	3084953
ES	3084953
FR	3084953
GB	3084953
IE	3084953
IN	201647020214
JP	6293884
KR	10-1689715
KR	10-1728293
NO	3084953
PT	3084953
US	9,294,016
US	9,294,017
US	10,090,786
WO	PCT/US2014/070542

## Flight Control for an Airborne Wind Turbine

US	9429954
----	---------

## **Methods and Systems for Determining a Priority Sequence for Changing a Position or an Attitude of an Aircraft in Hover Flight**

WO PCT/US2014/069558

## **Path Based Power Generation Control for an Aerial Vehicle**

AU 2014367205  
AU 2017213557  
AU 2019261693  
BR 1120160145054  
CN ZL201480075159.8  
CN 201710928823  
EP 14872510.4  
IN 201647024037  
JP 6185180  
JP 6609290  
KR 10-1737751  
US 9,317,043  
US 9,170,582  
WO PCT/US2014/061386

## **Curvature Sensing**

US 9,056,677  
WO PCT/US2014/068139

## **Methods and Systems for Managing Power Generation and Temperature Control of an Aerial Vehicle Operating in Crosswind-Flight Mode**

US 9,422,918  
US 9,429,141

## **Power Generation Using Rotor Speed Control for an Aerial Vehicle**

WO PCT/US2014/069288

## **Methods and Systems for Estimating an Orientation of a Tethered Aerial Vehicle Relative to Wind**

US	9,389,132
US	9,329,096

## **High Frequency Bi-Directional AC Power Transmission**

AU	2014374395
AU	2017203363
AU	2017219125
CN	201480076652
EP	14877412.8
IN	201647025290
KR	10-2016-7020624
US	9,151,272
US	9,567,979
US	15/391,389
WO	PCT/US2014/059235

## **Passive Variable Pitch Rotor for Airborne Wind Energy**

US	15/257,156
----	------------

## **Methods and Systems for Conserving Power During Hover Flight**

AU	AU2014366400
CN	ZL 201480069966.9
EP	14871262.3
KR	KR10-1745291
US	9,205,921
WO	PCT/US2014/069510



## **Methods for Perching**

CN	201480071596
US	9,156,565
WO	PCT/US2014/070366

## **Winding Technique for Minimizing Voltage Stress in a Motor**

US	9,621,003
WO	PCT/US2014/069732

## **(A) Dual-Pitch Support for a Propeller**

CN	201480075544
EP	14876835.1
US	9,878,775
US	15/665,386
WO	PCT/US2014/070918

## **Drive Mechanism Utilizing a Tubular Shaft and Fixed Central Shaft**

US	14/140,290
WO	PCT/US2014/060290

## **Systems and Apparatus for Cable Management**

CN	201480075782
EP	14871651.7
US	14/137,724
WO	PCT/US2014/068349

## **Systems and Apparatus for Wind Drum Mechanism**

CN	201480075262
US	9,475,589
WO	PCT/US2014/070653

## **Systems and Methods for a Winch Drum and Drum Door**

US	9,604,733
US	15/434,049

## **Sensor Equipped Tether Guide with Open Tether Channel**

US	US10,301,143
WO	PCT/US2017/061629

## **(A) Floating Counter-Balanced Levelwind Carrier**

US	10,280,034
WO	PCT/US2017/061630

## **Spar Buoy Platform**

AU	2014374174
CN	ZL 201480071795.3
CN	201910676406
EP	14877500
HK	16113582.9
US	9,308,975
US	9,327,845
US	15/143,027
WO	PCT/US2014/070937

## **Wind-Powered Vessel for Removal of Carbon Dioxide from Seawater**

US	9227168
----	---------

## **Biased Compound Radial Plain Bearing for Increased Life in Oscillating Pivot Motion**

US	9,353,792
WO	PCT/US2015/016629

### **Radiator and Duct Configuration on an Airborne Wind Turbine for Maximum Effectiveness**

US	9,835,139
WO	PCT/US2015/019390

### **Radiator Configuration for a Flying Wind Turbine that Passively Controls Airflow**

US	9,745,962
WO	PCT/US2015/019252

### **Airborne Rigid Kite With On-Board Power Plant For Ship Propulsion**

AU	2015247940
CA	2945751
EP	15779413.2
KR	10-2016-7031942
NZ	725143
US	61/981,050
US	9,353,033
US	9,248,910
US	9,784,243
WO	PCT/US2015/025553

### **High-Availability Multicast Network**

US	14/316,697
----	------------

### **Plastic Optical Fiber for Reliable Low-Cost Avionic Networks**

AU	2015284731
BR	1120160310357

### **Airborne Wind Turbine With Flight Computer**

CA	2951597
----	---------

## **Plastic Optical Fiber for Reliable Low-Cost Avionic Networks**

EP	15815543.2
KR	10-1745850
US	9,458,829
WO	PCT/US2015/034027

## **Apparatus for Attaching a Pylon to an Aerial Vehicle**

US	62/018,977
US	14/587,062

## **Attachment Apparatus for an Aerial Vehicle**

US	62/018,942
US	9,879,655

## **Low-Power Wide-Band Communication Links in High-Voltage Transmission Lines**

US	9,838,081
----	-----------

## **Horizontal Tail Surface**

US	62/019,412
US	9,764,820
WO	PCT/US2015/034023

## **Systems and Methods for Controlling Rotation and Twist of a Tether**

US	62/019,273
US	9,884,692
US	15/863,973
TW	I629214
WO	PCT/US2015/037091

## **Tether Winding**

US 62/021,516

US 14/588,105

## **Improved Tether Winding**

WO PCT/US2015/038766

## **Enhanced Accuracy for Tracking Tethered Airborne Vehicles**

US 9,214,022

WO PCT/US2015/036922

## **Power-Balancing Circuits for Stacked Topologies**

CA 2958192

CN 201580055332

EP 15832235.4

KR 10-2017-7006925

US 62/037,591

US 14/586,242

WO PCT/US2015/045190

## **Carbon Fiber Motor Rotor Integrating Propeller Mount**

AU 2015306936

CA 2959008

CN 201580056341

EP 15836339

KR 10-2017-7008307

US 9,664,175

US 15/491,619

WO PCT/US2015/046237

## **Tether Termination Systems and Methods**

TW	1593881
US	9,771,925
WO	PCT/US2015/055170

## **Airborne Wind Turbine Tether Termination Systems**

US	10,533,537
----	------------

## **Drive Mechanisms for Use in Controlling Rotation and Twist of a Tether**

TW	1619880
US	9,650,157
WO	PCT/US2015/037284

## **Pivoting Perch for Flying Wind Turbine Parking**

AU	2016233787
CA	2979335
EP	16765403.7
KR	10-2017-7025993
US	9,732,731
WO	PCT/US2016/019737

## **Ground Station for Airborne Wind Turbine**

US	14/929,003
----	------------

## **Hardpoint Strain Reliefs**

EP	16730605.9
JP	2017-561631
US	62/170,464
US	15/171,984
WO	PCT/US2016/035573

### **Motor with Multi-Phase Windings and Series-Stacked Inverter**

US 9698642

### **Tethers for Airborne Wind Turbines**

US 62/201,536

US 9,899,127

### **Combined Electrical and Mechanical Potted Termination for a Center Strength Member Cable**

US 9705302

### **Electro-Mechanical Bridles for Energy Kites**

CN 201680077139

JP 2018-525710

TW 105143792

US 14/984,369

WO PCT/US2016/065388

### **Power Management for an Airborne Wind Turbine**

US US10422320

US 16/554,608

### **Voltage Conversion for an Airborne Wind Turbine**

US 10,008,973

### **Battery for Fault Handling in Bidirectional Power Conversion Systems**

US 9,853,455

### **Fault Tolerance Control Strategies for Multi-Kite Power Generation System**

US 9948098

## **Systems and Methods for Flight Using Electric Tow Aircraft**

US 14/951,217

## **Control strategy for multiple kites on a single ground power unit**

US 62/260,246

US 9,767,700

US US10379546

## **Fault handling for motor controllers**

US 9,653,909

## **Tethers for Airborne Wind Turbines Using Electrical Conductor Bundles**

TW 1619881

US 9,947,434

WO PCT/US2016/068739

## **Lightning Detection for a Wind Energy System**

US 14/984,937

## **Dynamic Utilization of a Bidirectional Power Converter Stack**

US 14/986,264

## **Methods For Aerial Avoidance**

US 9,886,864

## **Torsion Relieving Power Cable**

US 62/404,295

US US10288501

WO PCT/US2017/055252



## **Systems and Methods for Recovery of Tethered Airborne Vehicle**

US 10,266,259

## **Tension Dampening Systems for Tethered Airborne Vehicle**

US 15/620,356

## **Aerodrome Energy Generation Systems and Methods**

US 62/403,637

## **Energy Kite with Auto-Rotating Rotors**

US 62/393,952

## **Offshore Wind Kite with Seafloor Mooring**

EP 17885355.2

US 10,518,876

WO PCT/US2017/056326

## **Offshore Wind Kite with Separate Perch and Tether Platforms**

CN 201780071979

EP 17885064

JP 2019-516605

US 15/387,476

WO PCT/US2017/057175

## **Integrated Tether and Mooring with Floating Platform for Energy Kite**

US 10,557,458

WO PCT/US2017/061525

## **Energy Kite Winching Using Buoyancy**

CN	201780069758
EP	EP17876876.8
JP	2019-516650
US	US10,309,374
WO	PCT/US2017/061571

## **Methods, Systems, and Devices for Tether Core Diagnostics and Monitoring**

CN	CN201780070696.7
EP	17859082.4
US	15/724,625
WO	PCT/US2017/055064

## **Tether Core Monitoring**

US	62/404,353
----	------------

## **Wind Energy Kite Tail**

US	D831,124
US	10,442,524
US	16/589,875
EM	003871422-0001/0005

## **Diagnostic Systems and Methods for Tether Manufacturing**

US	62/434,841
----	------------

## **Systems and Methods for Tether Core Diagnostics**

US	62/434,855
----	------------

### **Wind Energy Kite Wing Tip**

US	29/587,892
EM	3874593

### **Wind Energy Kite Nose Cowling**

US	29/588,786
EM	3874130

### **Systems and Methods for Yaw Control of Offshore Platform**

US	10310516
WO	PCT/US2018/020596

### **Methods and Systems for Controlling Motion of Floating Ground Station**

US	10,465,657
WO	PCT/US2018/064023

### **Multi-Tether Clock-Face De-Twist**

US	15/816,074
----	------------

### **Faired Tether Systems with Tail Span Sections**

US	62/567,459
US	16/130,176

### **High-Elongation Tensile Cable with Undulating Transmission Cable**

US	62/567,464
US	US10,311,998

### **Tether Guide with Two-Sided Open Tether Channel**

US	62/567,466
US	16/150,063
WO	PCT/US2018/053999

### **Faired Tether Systems with Internal Support Structure in the Faired Tether**

US	62/567,468
US	US10323353

### **Nodes for Multiple Aerial Vehicles Connected to a Single Ground Station**

US	10,145,356
US	10,502,179

### **Energy Kite Wing**

US	D857802
----	---------

### **Airborne Wind Turbine Tower**

US	15/840,981
WO	PCT/US2018/060917

### **Spar Buoy**

US	16/222,357
WO	PCT/US2019/061205

### **Constructive Dynamic Interaction Between Energy Kite and Floating Platform**

US	16/233,767
WO	PCT/US2019/056968

## **Use of Wave Energy by Energy Kite and Floating Platform**

US 16/233,763  
WO PCT/US2019/056965

## **Electronic Ropes**

US 60/521,200

## **Electronic Elongation-Sensing Rope**

US 7,516,605  
US 7,752,830

## **Controlling power extraction for wind power generation**

US 7,656,053  
WO PCT/US2008/008781

## **Bimodal Kite System**

US 11/901,262  
WO PCT/US2008/008791

## **Wind Power Generation**

US 7847426

## **Globally Coupled Collision Handling Using Volume Preserving Impulses**

US 61/062,942

## **Kite Efficiency Using Reinforced Internal Pressurized Beams**

US 61/123,081

### **Faired Tether for Wind Power Generation Systems**

US 12/154,685  
WO PCT/US2009/003179

### **Static Line Control for Wind Power Generation Systems**

US 12/154,668

### **Capstan Steering for a Kite**

US 12/218,984

### **Autonomous Kite Steering**

US 12/229,526

### **Tether Tension Control**

US 12/231,890

### **Fluid Filled Protective Gear**

US 12/291,996

### **Kite Efficiency Using Reinforced Internal Pressurized Beams**

US 12/384,472

### **Tethered System for Power Generation**

US 12/454,853  
WO PCT/US2010/001501

### **Transport Power Generation Using a Wing Structure**

US 12/455,313

## **Planform Configuration for Stability of a Powered Kite and a System and Method For Use of Same**

US	61/341,029
US	8,800,931
WO	PCT/US2011/029855
BE	2550076
CN	102917765
DE	2550076
EP	2550076
ES	2550076
FR	2550076
GB	2550076
IE	2550076
NL	2550076

## **Bridles for Stability of a Powered Kite and a System and Method for Use of Same**

US	9,352,832
US	9,630,711

## **High Strength Windable Electromechanical Tether With Low Fluid Dynamic Drag and System Using Same**

CN	103118941
CN	CN105161190B
EP	11810283.9
US	61/365,655
US	8,921,698
US	9,230,714
WO	PCT/US2011/044539

## Kite Configuration and Flight Strategy for Flight in High Speed Winds

CN	103282276
EP	11838810.7
US	61/409,894
US	8,922,046
US	9,896,201

## Flight Configuration and Flight Strategy for Flight Wind Speeds

WO	PCT/US2011/059146
----	-------------------

## Kite Ground Station and System Using Same

CN	ZL201280070041.7
DE	2791504
EP	2791504
EP	16205324.3
FR	2791504
GB	2791504
IE	2791504
JP	5908989
JP	6200020
KR	10-1611779
KR	10-1773312
NL	2791504
US	61/577,039
US	8,888,049
US	9,598,170
WO	PCT/US2012/070424



### **Motor Pylons for a Kite and Airborne Power Generation System Using Same**

US	61/582,408
US	8,955,795
US	9,555,895
WO	PCT/US2013/028120

### **Motor Control Topology For Airborne Power Generation and Systems Using Same**

US	61/751,817
US	9,611,835
US	9,866,152

### **Tethered Autonomous Air Vehicle with Wind Turbine**

US	61/082,031
US	8,109,711

### **High Voltage DC Tether**

US	8,497,423
----	-----------