



## Bio-inspired flying drones for monitoring, maintenance and repair

### Overview

Unmanned aerial vehicles (UAVs) or flying drones are becoming increasingly relevant in monitoring operations. Beyond using flying drones for ‘seeing’ (inspection at a distance), there are developments in increasing functionality to cover aspects such as package delivery. World-renown drones engineer Mirko Kovac and his team have built up a portfolio of intellectual property that extends the possibilities for drones in industry yet further, to tackle problems in direct-contact monitoring, maintenance and repair. Monitoring, maintenance and repair is particularly important in applications that are dangerous for humans and / or where resources to this end are minimal. Our portfolio of flying drones intellectual property (patents and know-how) has the potential to dramatically improve human safety in hazardous working environments, and reduce costs and time for first response maintenance and repair.

### Technology

Imperial Innovations has four primary technologies that advances the UAV ability to function as first response technology in maintenance and repair. These inventions are bio-inspired, and include (but are not limited to):

Technology	Description
<b>On-board 3D printing with polyurethane foam spray</b>	An aerial 3D printer aboard a UAV capable of printing materials that could be used for first response construction or emergency repair scenarios. Potential to greatly reduce the time between inspection and repair.
<b>String dispensing and perching</b>	Energy conserving UAV that can affix itself to a surface at a desired location by dispensing a web-like string and perching during non-flight tasks. Exponentially more effective than merely aiming to improve battery life.
<b>Multifunctional legs with attached propellers</b>	Spider like legs attached with propellers that enable a UAV to walk, fly, and or swim, attach to structures and easily alter the propeller incidence for optimal efficiency. Included is the ability to capture small material samples and manoeuvring of lightweight objects.
<b>Impact protection deployable origami bumpers</b>	UAV with deployable origami bumpers used during close proximity aerial maintenance and repair. Such technology could greatly reduce the weight and cost when compared to a traditional bumper technology. The volume pre-deployment is also reduced; the origami bumper can easily be folded away for more space efficient storage and transportation.

### Benefits

- Energy conservation
- Efficient motion
- Damage limitation
- Quicker response time
- Improved human safety
- Multi-medium (Walk, fly or swim)
- Improved precision
- Space-efficient, pre-deployment

### Intellectual Property

- String-based construction: PCT/EP2015/060128 (US-Pending)
- 3D scanning and multifunctional legs: PCT/GB2016/051426
- 3D printing and autonomous repair: PCT/GB2016/051427
- Foldable origami bumpers: 1509509.4, 1600130.7 (UK Priority application numbers)

Brian Graves

Director of Business Development

e: [brian.graves@imperialinnovations.co.uk](mailto:brian.graves@imperialinnovations.co.uk)

t: +44 (0)20 3053 8809

w: [www.imperialinnovations.co.uk](http://www.imperialinnovations.co.uk)

Technology reference numbers:  
7082, 7398, 7399, 7502, 7751

## Potential Applications

Dangerous working environments, repetitive tasks, aerial tasks and maintenance and repair:

- Agriculture
  - Pesticide control, weed removal
- Forestry (& fire management)
- Monitoring of livestock
- Construction
  - Roof repair & inspection
  - First response construction
- Civil Engineering
  - Building & repairs
- Building services management
- Building painting and decoration
- Aeronautical Engineering (maintenance, repair and overhaul; MRO)
  - Mid-flight repairs
- Military / defence
  - Remote autonomous bomb removal
  - Emergency structure construction
- Surveillance
- Oil & Gas
  - Emergency pipeline temporary repair
  - Collecting samples in inaccessible areas
- Process Industries (e.g. fine chemicals)
- Waste and sanitation
- Nuclear reactor safety
- Utilities
  - Transmission lines repair
  - Emergency repair scenarios
- Solar farm maintenance
- Mining
- Humanitarian aid
  - Search & Rescue
  - Emergency rescue shelter construction



### Imperial Innovations

52 Princes Gate,  
Exhibition Road,  
London, SW7 2PG

**Tel:** +44 (0)207 581 4949

**Email:** [info@imperialinnovations.co.uk](mailto:info@imperialinnovations.co.uk)

**Web:** [www.imperialinnovations.co.uk](http://www.imperialinnovations.co.uk)