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SUBMISSION TO THE

AUSTRALIAN SENATE RURAL AND REGIONAL AFFAIRS AND TRANSPORT REFERENCES STANDING COMMITTEE

ON

REGULATORY REQUIREMENTS THAT IMPACT ON THE SAFE USE OF REMOTELY PILOTED AIRCRAFT SYSTEMS, UNMANNED AERIAL SYSTEMS AND ASSOCIATED SYSTEMS

15 December, 2016

Dear Members of the Committee,

Thank you for the opportunity to provide a submission for the inquiry on *Regulatory requirements that impact on the safe use of Remotely Piloted Aircraft Systems, Unmanned Aerial Systems and Associated Systems*.

Who am I?

My name is Philip Hall. An Australian currently living in the United States, I am a Founding Director and the Chief Executive Officer of RelmaTech Limited. I am also an Associate Professor (At Large) with the Department of Electrical and Electronic Engineering at The University of Melbourne (Australia) where I support collaborative international research programs focused on the practical application of emerging technologies. Previously I held tenures as Adjunct Professor at The University of Western Australia, and The University of the South Pacific.

This year I participated in the Drone Outlook Study conducted by the Single European Sky Air Traffic Management Research Joint Undertaking (SESARJU) as a member of the Innovation Reference Group. In December 2015, I chaired an Industry Summit convened by RelmaTech on *An International Digital Identity Protocol for Remotely Piloted Aircraft Systems* at London Gatwick Airport. I also organised and chaired exclusive seminars in Melbourne (2014) and Washington DC (2015) to consider the *National Security and Societal Implications of Remotely Piloted Airborne Vehicles and Related Technologies,* and in March 2015 I attended the International Civil Aviation Organisation (ICAO) Remotely Piloted Aircraft Systems (RPAS) Symposium in Montreal as a guest of the ICAO RPAS Program Office. In 2013 I co-chaired a high-level roundtable sponsored by the Australian Government to consider the role of new technologies in Securing Australia's Future, and participated in the 2nd World Emerging Industries Summit in China as a guest of the Asia-Pacific CEO Association and the Wuhan Municipal Government.

I am a Fellow of both the Australian Institute of Management and The Institution of Engineers Australia, and a Senior Member of IEEE. In IEEE I am a member of the Aerospace and Electronic Systems Society (AESS) and the Society on Social Implications of Technology (SSIT). In AESS I am Vice Chair of the UAV Technical Panel, and in SSIT I am a Member and Vice President of the Board of Governors. I am also a regular guest editor of the SSIT Technology and Society Magazine, and an associate editor of the CSP Journal of Unmanned Vehicle Systems.

I currently serve on the IEEE-USA Government Relations Council (GRC) as Chair of the Committee on Transport and Aerospace Policy (CTAP), and also as Co-Chair of the Ad Hoc Committee on Artificial Intelligence Policy. The GRC provides policy advice to the U.S. Administration and Congress. I was the lead author of the CTAP Position Statement on *Unmanned Aircraft Systems and Related Technologies* (available at http://www.ieeeusa.org/policy/positions/UAS1115.pdf), and am also lead author currently updating the 2012 CTAP Position Statement on the U.S. *National Airspace System*, which will, among many aspects, address integrating RPAS into the U.S. National Airspace.

I also currently represent the GRC on the Executive Committee of the IEEE *Global Initiative for Ethical Considerations in the Design of Autonomous Systems*, and it's Committee on *Effective Policymaking for Innovative Communities involving Artificial Intelligence and Autonomous Systems*. I am also a member of IEEE-SA Working Groups for IEEE P7000™ *Model Process for Addressing Ethical Concerns During System Design* and IEEE P1920.1™ *Aerial Communications and Networking Standards*.

A former Aeronautical Engineering Officer in the Royal Australian Navy (RAN), my military aviation experience includes aircraft operations at sea, major aircraft procurement and aviation infrastructure construction projects, and aircraft engineering policy development in Defence Headquarters.

About RelmaTech

RelmaTech is a UK-based company specialising in the development and operation of integrated technology-based solutions that provide for the safe and secure management of autonomous and semi-autonomous land, marine and air vehicle operations. RelmaTech also has representation in the United States and Australia.

RelmaTech currently has international patents pending for its Secure Integrated Airspace Management (SIAM) system. SIAM is a viable and robust solution that has the functionality and operational capabilities to ensure that low-flying RPAS operations are safe for the full range of potential users by solving the central problems confronting policy makers, regulators and the public:

- Pilot and Aircraft Identification,
- Airspace Management, and
- Incident Management.

SIAM is currently being used in Australia by V-TOL Aerospace in support of their commercial operations. As part of their technology development for minimising risk to third party airspace users, V-TOL are now fitting SIAM to all their aircraft, including aircraft V-TOL build for its customers (see press release at http://www.suasnews.com/2016/08/relmatech-v-tol-claim-worlds-first-commercial-rpasutm-flights/)

An overview of SIAM is provided later in this Submission against Terms of Reference Part E.

Introduction to the Submission

This submission is intended to present an initial argument that insufficient attention has been paid to identification of both RPAS and their owners (whether commercial or recreational users) and their operators (Remote Pilots), and to offer a concept which, if implemented, will permit registration of RPAS and their pilots and lead to increased safety, enable more effective oversight of both commercial and recreational RPAS operations, and, over time, move RPAS into an effectively regulated sector of the Australian (and International) aviation industry.

This concept can be applied so that any regulator with an interest in RPAS can develop an effective set of data to improve compliance and yet allow operations to the permitted limits.

Please note that, for the purposes of this submission, the term RPAS has been used to include Unmanned Aerial Systems and associated systems.

Initial Premise

In conventional manned aviation (CMA), the registration of aircraft is mandatory, no matter whether they are commercial aircraft (carrying passengers or freight, conducting aerial work and so on), general aviation aircraft, recreational aviation aircraft (including a variety of ultra-light aircraft types and gliders) or similar types. Registration carries costs, that are typically borne by the owners, and overseen by (in Australia's case) the Civil Aviation Safety Authority, or a self-administering body which is effectively standing in CASA's place with responsibility to maintain safe operation in Australia's national airspace. The question that follows is whether **ALL** RPAS should come under some similar umbrella. The issues of cost and ease of registration need to be recognised, considered and addressed in a realistic fashion.

Similarly, in CMA, all operators and flight crew (pilots) are required to hold an appropriate certificate or licence that shows the company or individual has a level of proficiency, knowledge and implements sound processes appropriate for the operation being conducted. If an event occurs that impacts safety in any significant way the responsible authority will establish the bona fides of the vehicle, operator and pilot concerned by checking the registration, certification, licences and technical standard and state of those involved.

The ability to identify the RPAS pilot, owner and/or operator and track (and record) the movement of RPAS in real-time would also greatly reduce the risks associated with the operation of RPAS in the unenforceable and random fashion currently in place.

Terms of Reference Part A – Regulatory Requirements

Background

Near collisions with commercial aircraft and numerous other high-profile incidents involving RPAS are becoming more frequent and present major issues for policy makers, regulators, law enforcement agencies and the public. Such incidents must avoided if the emerging drone industry is to mature and thrive, and therein resides the opportunity for industry to proactively take the lead in providing practical and timely solutions based on government and regulatory guidance.

Senior managers in several major national aviation authorities: the U.S. FAA, CAA-UK, CASA, Transport Canada and NAV Canada, and the IAA have acknowledged in discussions with RelmaTech

that it is not a question of IF, but WHEN, governments will regulate that all civilian RPAS must be fitted with a unique and secure digital identifier during manufacture, and be registered with a designated statutory agency at the time of acquisition – or for custom-build aircraft, when they are presented for airworthiness certification. Similarly, it is also foreseeable that governments will regulate that RPAS pilots must be licenced (with their details registered with a designated statutory agency), and that RPAS must have an on-board means of identifying the pilot while the aircraft is being operated.

Essential to the future of the drone industry is implementation of a safe and secure airspace management system for civilian RPAS operations; a system that enables new and innovative RPAS applications while resolving the concerns and issues of policy makers and the needs of regulators. Critical to an effective airspace management system for low flying RPAS is the ability to identify in real-time an operating aircraft, its owner and pilot, and its precise location. Until now, such an airspace management system did not exist, and projects working to design and develop an infrastructure solution to enable and safely manage the widespread use of low-altitude RPAS operations in the national airspace have indicated that one would not be available until 2019.

Understandably, regulators and manufacturers have not aggressively pursued a solution to the aircraft and pilot identity issues if a system will not be available for several years to effectively utilise that capability. But there is a solution to the aircraft/pilot identity issue and an airspace management system available now that incorporates digital identification of aircraft and pilot as an integral part; that system is RelmaTech's SIAM. The immediate priority of policy makers and the drone industry therefore must be to embrace the need for aircraft and pilot digital identification and promote its early implementation.

RPAS Aircraft and Pilot Registration

Any discussion on RPAS aircraft and pilot registration must start with the notion that Registration is a key component of Identity, and that Identity should be considered within the context of the desired "degree of effectiveness", which can be simply illustrated by a suite of Pro-active and Re-active identity measures, as shown in Figure 1. The implementation of Pro-active identity measures using digital technologies (i.e. digital identification) enables a National Aviation Authority (NAA) to safely manage its airspace by being able in real-time to:

- identify an RPAS aircraft, its owner and pilot;
- verify their flight and operating permissions;
- accurately track the aircraft's location; and
- detect violations of RPAS regulations and initiate appropriate enforcement actions.

Re-active identity measures include maintenance of an RPAS aircraft register (containing aircraft and ownership information) and regulations requiring basic analogue identity – such as it being mandatory for registration numbers to be affixed to the exterior of the aircraft and be visible for ease of inspection. While these measures enable an NAA to identify an RPAS aircraft and its owner by visual observation and registration database enquiries – typically performed AFTER an incident has occurred to determine accountability – by themselves they do not enable the safe management of the airspace.

It is argued, therefore, for NAA's to provide a safe airspace for RPAS, an integrated suite of Pro-active and Re-active identity measures are required; measures that enable the RPAS aircraft and its pilot to be identified, their permissions verified, and the aircraft's position to be tracked whilst in

flight. The combination of Pro-active and Re-active identity measures has proven to be extremely effective in safely managing environments in which cars, aircraft and maritime vessels operate today – and it is rational that a safe airspace for RPAS operations can be achieved in the same way.

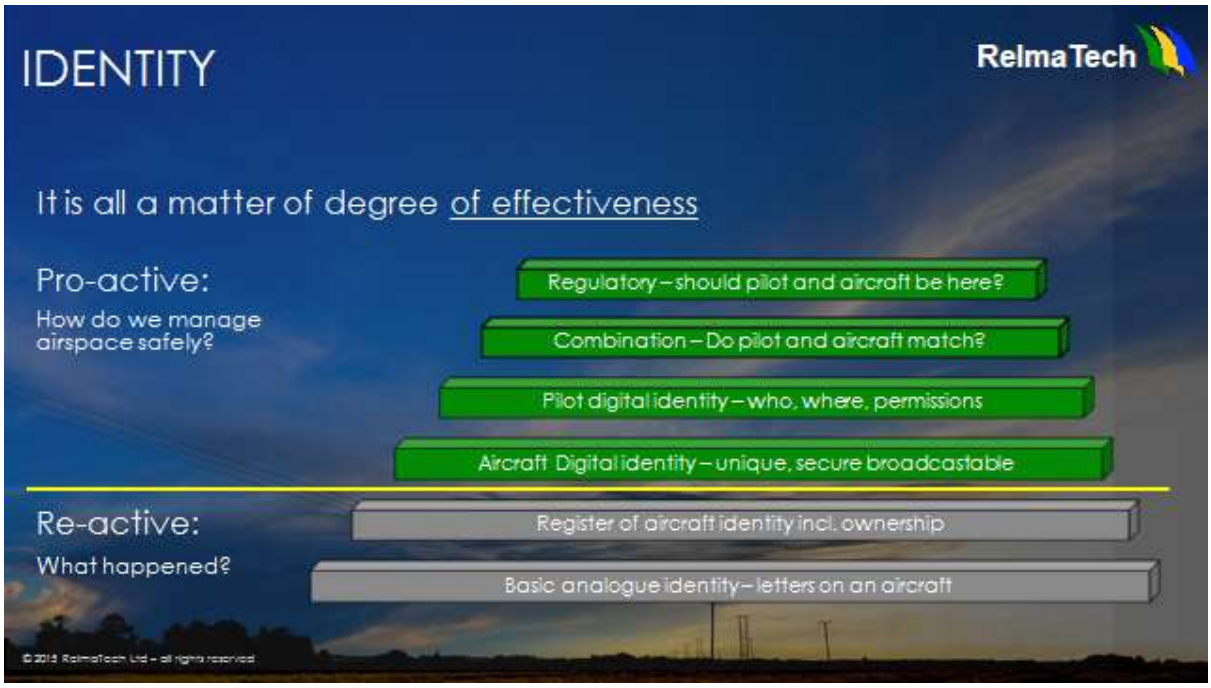

Fig. 1: Identity described in terms of "effectiveness"

In the latter half of 2015 several countries (including the United States, United Kingdom, Ireland and Germany) announced that addressing the issue of RPAS registration was a high priority. The most publicised was the FAA's establishment of an Unmanned Aircraft Systems (UAS) Registration Task Force (RTF) Aviation Rulemaking Committee (ARC) to provide recommendations to the FAA "on registration requirements and process for small UAS, including those used for commercial purposes, and all model aircraft."

The FAA Task Force Recommendations Final Report states that the objective of the Task Force "was to develop recommendations for the creation of a registration process, which ultimately would contribute to an enforceable rule imposed by the FAA." The Report also stated that "the intent of establishing this registration framework was to promote a culture of accountability while achieving a maximum level of compliance". It must be noted that the registration system recommended by the FAA Task Force- and subsequently implemented – is owner-based, where each registered owner has a single registration number that covers any and all RPAS that the registrant owns, and that registrant's registration number must be affixed to the aircraft unless the registrant chooses to provide the FAA with the aircraft's serial number. As such, the FAA Task Force Recommendations Report only contributes to the Re-active layers of the Identity framework and therefore do not directly contribute to the development of a safe managed airspace for RPAS operations.

Policy makers must also consider whether the current regulatory focus on addressing the identity issue by establishing registers for RPAS owners was legally sustainable, commercially sustainable, or even insurable. Comments on those points are provided later in this Submission against Terms of Reference Part G.

Terms of Reference Part E – Relationship between Aviation Safety and Regulation

RelmaTech recognises that the drone industry can provide enormous benefit to society as a whole as the technology is adopted across a wider range of applications. RelmaTech agrees with policy makers that drone operations should be safe above all else, and that pilots should be responsible, and be seen to be responsible, for safe operations. A managed airspace achieves this, and that is why RelmaTech has developed SIAM.

Background

1. The Challenge:
    a. RISKS ARE MATERIALISING
        i. Rapid, uncontrolled growth in RPAS.
        ii. Increasing number of incidences of interference with security, military and public safety environments.
        iii. Total inability to see or manage the airspace now occupied by these devices.
    b. REGULATORY ENVIRONMENT
        i. Many existing regulations for piloted aircraft are inadequate and/or inappropriate for RPAS.
        ii. Regulations do not adequately address RPAS aircraft and pilot international mobility.
        iii. Regulation without enforcement is not viable.
    c. TIMELINE
        i. The longer a solution takes to be agreed the more difficult its implementation.
        ii. The UTM NASA solution reportedly will not be available until 2019 – a practical solution is needed much earlier.

2. Regulatory issues:
    a. RESPONSIBILITY – the pilot is responsible for the operation of the RPAS at all times, irrespective of the level of autonomy.
    b. LOCATION:
        i. The pilot must know where the RPAS is at all times.
        ii. The RPAS must know where the pilot is at all times.
        iii. The RPAS aircraft and/or pilot may be of foreign registration/licensing – national operating restrictions may apply.
    c. SITUATIONAL AWARENESS
        i. The pilot must be aware of what is going on around the RPAS including the inherent risks and dangers.
        ii. The pilot must be aware of the legal obligations in relation to his/her operation of the RPAS (privacy, nuisance, No Fly Zones, etc.)
    d. INTERVENTION – legal intervention must be possible in exceptional circumstances. For example, for the enforcement of No Fly Zones.

3. The Objective:
    a. CREATE A VIABLE GLOBAL SOLUTION DELIVERABLE ON SHORT TIMELINE (<12 months) – commercial market growing at CAGR 19%; time is of the essence.
    b. CREATE ABILITY TO IDENTIFY RPAS PILOT AND AIRCRAFT TYPE/OWNERSHIP
        i. No current means of determining the identity of an RPAS pilot and his/her license status and type.

ii. Existing aviation regulations do not provide for digital aircraft and/or pilot identification.
iii. Digital identification complements – not replaces – existing aviation registration regulations and numbering schema.

c. CREATE ABILITY TO MANAGE AIRSPACE
i. Permit RPAS operations based on known aircraft and pilot permissions, national regulations and airspace restrictions.
ii. Track and monitor RPAS in flight in real time against regulations and specified permissions.
iii. Establish and enforce Permanent and Temporary No Fly Zones.
iv. Provide for detect and avoid by separation assurance and collision warning of other RPAS/obstacles/obstructions.

Proposed Solution: SIAM – Secure Integrated Airspace Management for RPAS

RelmaTech's SIAM system is a global solution founded on existing operating principles and supported by proven technology. It brings proven, credible, secure and scalable global solutions together, comprising:

- Identity Management
- Airspace Management
- Incident Management
- Reporting Capabilities

A high-level system overview of SIAM is provided at Figure 2.

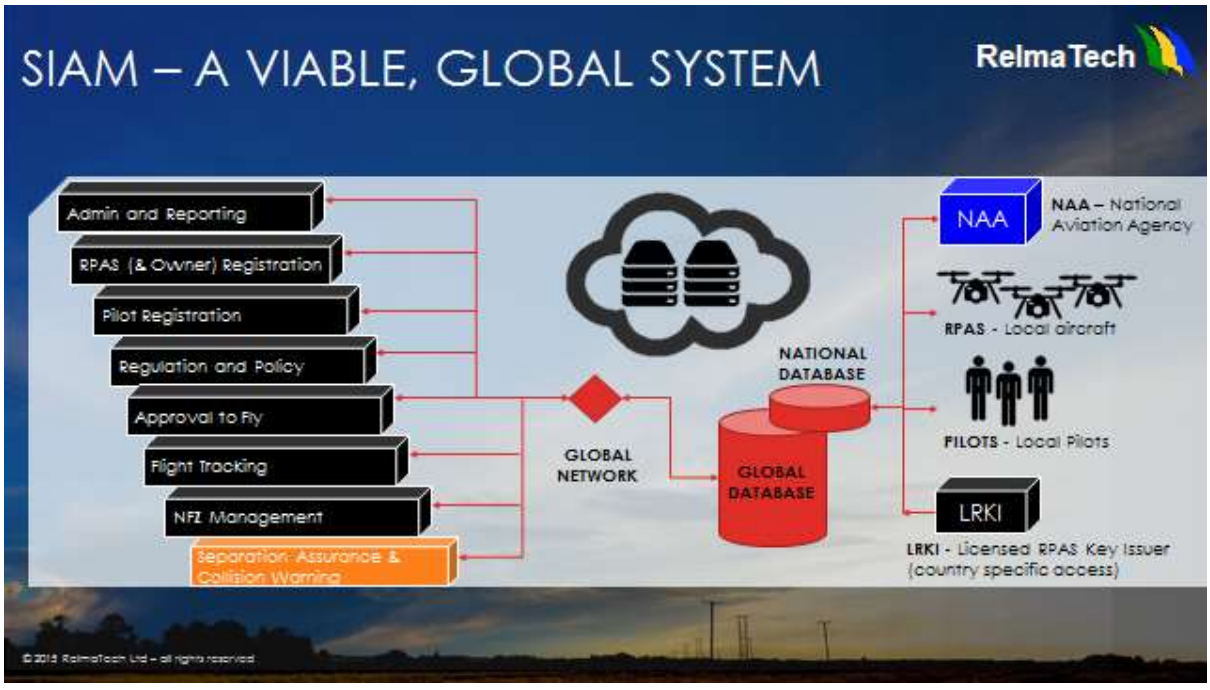

Fig. 2: SIAM – high-level system overview

SIAM – Capability overview

SIAM offers a viable and robust global solution to the two overarching issues confronting policy makers and regulators:

1. How can the forecast proliferation of RPAS operated by private enthusiasts and commercial enterprises be safely managed in the airspace below 500 feet; and more critically, and
2. How can the accompanying need to be able to establish the identity of an RPAS, its owner and its pilot (noting that the owner of the RPAS may or may not be the pilot of that RPAS) be best satisfied within the context of a managed airspace?

Through the innovative integration of proven technologies and concepts used in civil aviation, global online and mobile communications and information management, SIAM works in combination with the rational application of existing transportation systems and practices to ensure that small RPAS operations are safe for the full range of potential users – personal, commercial, institutional, corporate, government, essential civil services, national security and defence.

An integral part of SIAM is the RPAS Key – an on-board SIM-type digital device – that enables the aircraft, its owner and pilot/operator to be identified and their permissions verified – and, where necessary and legally permissible, restricted. SIAM uses that information to determine whether the flight to be undertaken is restricted to Line of Sight or permitted for Beyond Line of Sight, and then oversees the flight accordingly.

SIAM also uses state-of-the-art technologies to provide the ability to establish and enforce permanent and temporary No Fly Zones, and to interface with ground-based control systems specifically designed to simultaneously operate multiple RPAS. These and other capabilities, including separation assurance and collision warning – which also rely on digital identification – ensure that RPAS can be safely operated within an integrated managed airspace. Importantly, SIAM offers an operative digital and independent substitute for ADS-B and secondary radar, and provides a remote “black box” facility that acts as a secure repository of the RPAS flight history.

SIAM – Five simple elements for success

1. Digital identification – onboard devices that identify the aircraft and its pilot – the Aircraft Identification Number (AIN) and the RPAS Key.
2. A National Airspace Management system – approve and track RPAS flights against current national regulations, establish and monitor No Fly Zones, provide live feeds to appropriate 3rd parties.
3. A Central Incident Management system – enforces No Fly Zones and initiate legal intervention if required.
4. A Central Reporting system – standard and customized reports on system performance metrics, incident reporting, 3rd party application data, etc.
5. Commercially viable – relatively easy for national aviation agencies to incorporate SIAM within existing aircraft registration and pilot licensing regulations, commercial frameworks and business processes.

SIAM – Proven technologies

1. Existing technical building blocks with proven globalization, providing secure:
    - Reliable global identity system for the RPAS pilot and aircraft.
    - Land-to-air communications channels for data transfer between RPAS and SIAM.
    - Global communications infrastructure for registration, identification and tracking.

- High integrity back-office systems and databases.

2. Secure, low bandwidth communications:
   - Proven secure communications technology integrated to create active airspace identification and tracking system.
   - Optimised burst-data packets ensure very low bandwidth requirement – no load on communications system.
   - Integrated logic in RPAS module caters for communication failures and network outages.

SIAM – A rational approach

SIAM provides the mechanism for enablement and enforcement of regulations designed to provide a safe airspace for all:

- Like driving a car, or flying a light aircraft, we insist that people in charge of a vehicle that has a public safety element to its operation (such as a car or airplane) are trained and licensed. Given the issues and challenges we now face, we must treat RPAS as such a vehicle.
- The standard feature for accessing or activating a vehicle is usually a key. Typically the driver/pilot is in the vehicle, so is easily identified in event of an incident. In the case of RPAS, the RPAS Key is the physical proxy for the pilot because it contains the identity and licence status of the pilot, while enabling the pilot to operate the RPAS remotely.
- We drive/fly according to a set of established and community-accepted rules and regulations that are legally enforceable. For RPAS we must do the same.

More information

RelmaTech has provided briefings on SIAM's capabilities and operational potential to the FAA, CAA-UK, NATS-UK, CASA, TC and NAV Canada, and the IAA. Those briefings have been very well received, with commitments for follow-up discussions and system demonstrations. RelmaTech would welcome the opportunity to provide a briefing on SIAM to Members of the Rural and Regional Affairs and Transport References Committee.

Terms of Reference Part G – Insurance

The Lloyd's new Emerging Risk Report – *Drones Take Flight: Key issues for insurance,*[1] which looks at the challenges around the development of insurance solutions for drones, highlights a number of concerns around safety, security and surveillance that could pose significant risks to drone operators and manufacturers, and could hamper the sector's growth.

The report identifies five fundamental risks facing the sector:

1. Negligent or reckless pilots
2. Patchy regulatory regimes
3. Poor enforcement
4. Vulnerability to cyber attack
5. Privacy infringement

[1] Drones Take Flight – Lloyds Emerging Risk Report 2015 available online at: http://www.lloyds.com/news-and-insight/risk-insight/library/technology/drones-take-flight

The report identifies three key areas that must be developed for the effective provision of insurance for drone operations:

1. Regulation – through the implementation of a robust, internationally-harmonious regulatory framework.
2. Safety – through the continued development of training and licensing schemes, and further enhancements in 'sense and avoid' technology.
3. Security – through the application of sufficient cyber security measures.

The report also warns drone manufacturers that they must also be prepared to manage their increasing vulnerability to intellectual property and product liability risks.

With respect to **Regulation**, the report recognises that effective regulation is a key factor for insurers' confidence in any emerging technology and identifies the shape that regulation could take in order to mitigate risk:

1. Enforcement – key measures are maintaining a database of approved operators and affixing serial numbers on fireproof plates. Additional technology measures include:
    - Tracking/monitoring technology incorporated as integral part of platform design.
    - Geo-fencing to prevent straying from authorised areas or into controlled airspace.
2. Licensing – the ability to assess operator competence with global consistency is an essential consideration for the provision of insurance
3. Third Party Liability – liability considerations are expected to become increasingly significant for drone operations as they expand in scope.
4. Harmonisation – as regulatory regimes develop, the degree of international harmonisation could be a key factor in enabling the development of standard insurance wordings and cover for drone operations.

The report concludes that drone manufacturers and users could face increasingly complex and high value risk exposures as the market continues to expand, and will need to work with regulators and insurers "on a global basis" to ensure the technology is used safely and responsibly. By providing the support needed for the systems to operate safely and with due regard for third party interests, the insurance industry has the potential to act as an enabler for the successful adoption of this emerging technology.

With respect to **risk and the safety of the non-flying public**, the FAA Registration Task Force had adopted a mass-based approach to determine an appropriate category of small UAS to recommend for exclusion from the registration requirement. The mass-based approach was chosen based on the probability of a catastrophic event occurring (i.e. death or serious injury) due to a collision between a small UAS and a person on the ground.[2] While the rationale leading to this choice is arguable, the application of it by the FAA Task Force is seriously flawed.

Firstly, the FAA Task Force argued that, "because of the lack of data on UAS-aircraft collisions, engine ingestion, propeller, and rotor impacts by UAS, the probability of a catastrophic event occurring due to those events was not part of the consideration."[3] Taking this position amounts to deliberately ignoring the real risks associated with the small UAS operating environment; risk and public safety

[2] FAA Task Force Recommendations Final Report of November 21, 2015, pp6-10

[3] ibid, p6

must be considered in the context of all risk vectors, from malice, negligence and incompetence through to act of god, unintended consequence and rare-events. It should be expected that insurers are heading this way.

Secondly, to determine the likelihood of a catastrophic event (calculated in the Report as $4.7x10^{-8}$, or one ground fatality for every 20,000,000 flight hours of a small UAS), the FAA Task Force chose as a basis for its calculations the scenario of an object dropping in free-fall from 500ft above ground in a vacuum. This scenario has no value as it represents an extremely small area of public risk compared to the real world issues. A more appropriate – and much more likely – scenario of a catastrophic event is that of a small UAS travelling at full speed close to ground level and colliding with a person in the head/shoulders/upper body region where the impact is more likely to cause serious injury or even death.

The 2015 incident in the UK where a toddler lost an eye as a result of being hit in the face by a neighbour's out-of-control small UAS is a demonstrable example of why the approach and scenario adopted by the FAA Task Force as a basis of its risk assessment is not representative of real world risks and issues.[4] Fortunately, as the owner/pilot was present at the time, the matter of aircraft owner and pilot identification – and therefore, accountability – was not an issue.

Terms of Reference Part I – Other related matters and submission summary

1. **Registration** – be it for aircraft, owner or pilot – is a Re-active measure of "identity effectiveness". Registers may enable regulators to determine the WHO and WHAT, but not the WHERE, WHEN, HOW and WHY.

2. **Secure Integrated Airspace Management** – exists today (RelmaTech's SIAM system), and provides the mechanism for enablement and enforcement of regulations designed to provide a safe airspace for all. Capabilities, including flight tracking, separation assurance and collision warning – which rely on aircraft digital identification – ensure that RPAS can be safely operated within an integrated managed airspace.

3. **Pilot identification** – an integral part of RelmaTech's SIAM system is the RPAS Key – an on-board SIM-type digital device that acts as the physical proxy for the pilot because it contains the identity and licence status of the pilot, while enabling the pilot to operate the RPAS remotely. The RPAS Key enables the aircraft, its owner and pilot/operator to be identified and their permissions verified – and, where necessary and legally permissible, restricted.

4. **Regulatory needs** – fundamentally, there are three key things that need to be addressed for the regulator:
    - What is it?
    - Where is it?
    - Who is in control, and are they aware of the situation around them?

[4] See: http://arstechnica.co.uk/tech-policy/2015/11/toddler-loses-eyeball-after-errant-drone-slices-it-in-half/

5. **Airspace Integration** – the capabilities of new and novel aircraft to be accommodated and eventually integrated into the airspace need to be considered in terms of the total aviation system and its enabling technologies.

6. **Insurance – regulation** – drone manufacturers and users could face increasingly complex and high value risk exposures as the market continues to expand, and will need to work with regulators and insurers "on a global basis" to ensure the technology is used safely and responsibly. Effective regulation is a key factor for insurers' confidence and key measures for regulatory enforcement are maintaining a database of approved operators supported by additional technology measures including aircraft tracking/ monitoring technology incorporated as integral part of platform design.

7. **Insurance – risk and public safety** – in determining the likelihood of a catastrophic event (i.e. causing death or serious injury), risk and public safety must be considered in the context of all risk vectors, from malice, negligence and incompetence through to act of god, unintended consequence and rare-events. Ignoring these risk vectors because of a lack of data on UAS-aircraft collisions, engine ingestion, propeller, and rotor impacts by UAS, etc. is to ignore the real risks associated with the environment in which UAS are operating (whether legally or illegally).

8. **Legal** – the operator of a drone is responsible for its use. When a drone service is delivered in prohibited airspace, in an unsafe manner, or for illegal purposes, the authorities should be able to act and hold the operator accountable. Where lacking, this will need to be clarified in national law. To enforce responsibility, it will be necessary for drones to have at all times an identifiable owner or operator. The regulator should seek the least bureaucratic way to achieve this.

9. **Policy perspective** – the industry must take pro-active and meaningful steps to avoid government over regulation in "knee-jerk" response to a national security or public safety situation. When the inevitable happens and there is a major incident or event with a drone, Government will need and want a ready-made solution, and the company that is ready and capable to deliver that solution, will be very well placed.

Thank you for the opportunity to provide this submission for your consideration. I look forward to hearing the outcomes of this inquiry.

Yours Sincerely,

Philip Hall
Founding Director & CEO, RelmaTech Ltd (UK)