



WHITEPAPER

Implementing Mode 5 IFF Transponders on UAS: What to Consider

Crewed aircraft worldwide have implemented NATO's requirement for Mode 5 Identification Friend or Foe (IFF) transponders using physically large devices. However, for uncrewed aircraft, down to class 2, the challenges of smaller UAV airframes require new solutions and long-term thinking for a successful Mode 5 IFF transponder implementation.

The minimum specifications for Mode 5 IFF UAS transponders include:

- Certification to DoD AIMS 17-1000 Mark XIIB
- Civil modes A, C, and S functionality
- ADS-B Out
- Mode 5 response prioritization
- Antenna diversity for space-based and ground-based visibility
- Incorporation of internal crypto, or compatibility with an external crypto computer such as the KIV-77
- Satisfaction of the robust environmental standards of MIL-STD-461 and MIL-STD-810.

Keeping these basic requirements in mind, here's what we recommend you consider when you need to implement a Mode 5 IFF micro transponder, such as Sagetech's MX12B Mode 5 IFF micro transponder, into your UAS.

Essential Transponder Features to Consider

Size and Weight

Military legacy Mode 5 IFF transponders are very large by UAS standards – even the “mini” transponders can weigh in at about 6 pounds without the crypto appliqué. In UAS applications, size, weight, and power affect aircraft agility, flight longevity, and a host of other mission critical performance requirements. Reducing the SWaP footprint in a transponder allows system designers to maximize the performance capability of the aircraft. Specifying a certified micro transponder can reduce your transponder size by up to 6x and weight by up to 93%. Compliant with the DoD AIMS 17-1000 specification, look for a micro-sized transponder that offers all the required functionality in a microelectronics format, with no deviations. Today's units weigh in at under a pound.

Power Output

For UAS, there is an appendix to AIMS 17-1000 that allows for reduced output power from transponders on uncrewed vehicles. However, we believe that can ultimately prove limiting for your aircraft's longevity and application across missions. Don't skimp on output power and range – specify a micro transponder that includes the same output power as legacy larger-sized transponders, which is 57 ± 2 dBm.

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Antenna Diversity

Again, for UAS, the appendix allows for a single antenna vs a dual antenna on small, unmanned aircraft. However, if you are looking to specify one micro transponder across multiple vehicles or programs, we recommend you specify one that offers the dual antenna technology but can operate in both single antenna and diversity modes. Additionally, using a diversity antenna system will only enhance your transponder's performance in mission-critical situations.

ADS-B In and Out

While the spec only calls for ADS-B Out, integrated ADS-B In provides better situational awareness and ease of implementation. Mode 5 IFF is used when the aircraft is in military combat or training modes. However, a military UAV may also need to fly within the national airspace system (NAS) at some point. If so, it will need ADS-B In capability for situational awareness and communication with ATC and TCAS. Ensure your transponder includes this functionality, natively integrated, to save engineering integration time.

Flexible I/O

Ethernet rules the day and may be required to provide enough bandwidth to support many ADS-B tracks, but legacy technologies of RS-232 and RS-422 can be effectively used for transponder control. Cover all potential situations with a transponder that offers all standard options.

Updated Certifications

The Military Mode 5, DoD AIMS 17-1000 Mark XIIB specification replaces the legacy DoD AIMS 03-1000 Mark XIIA specification with updated requirements that dictate stronger encryption, different response prioritization in the transmitter, and GPS information about target aircraft locations. Update your legacy programs and specify solutions for new UAS programs with transponders officially certified to this new level. Like the legacy transponders, today's new certified micro transponders offer the performance assurance of rigorous, methodical testing against thousands of requirements within DoD AIMS 17-1000.

Upgrade Capability

Specifications are continually evolving, and soon we expect new specifications for Mode 5 Level 2B In and Out. Ensure your micro IFF Mode 5 transponder carries an upgrade path to include this future requirement.

Military Heritage

IFF mission capability is serious, requiring significant technical expertise and complexity. Select a supplier steeped in military program experience to ensure military-proven technology, stability of supply, obsolescence policies, and logistics abilities including spares.



The above considerations are specifically offered with an exclusive focus on Mode 5 IFF applications. When specifying micro transponders for Mode 5 IFF requirements, don't just look for minimalist specs. Think long-term, across multiple platforms and programs, to ensure what you specify works both today and tomorrow.

Sagetech is an aerospace technology company, empowering safe flight with the world's most reliable UAV transponders. Experience serving military and civil duty on most small to medium UAVs, Sagetech solutions are mission-proven and offer decades of program experience, certifications, and millions of flight hours to deliver maximum value over the life of an uncrewed platform. Today Sagetech is expanding its technology platform to create comprehensive situational awareness systems, such as detect and avoid solutions for uncrewed aircraft as well as collision avoidance for crewed and optionally crewed rotorcraft. Sagetech works in concert with its extensive ecosystem of OEM customers, technology partners, and resellers to ensure aircraft fly safer with Sagetech on board.



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