Frequently Asked Questions to MILSATCOM RFI

Frequency Band Usage: *Are the different frequency bands intended to be used in parallel, or is there a specific sequence or priority for their use?*

As mentioned in MIS-01 of section 2.3 of the RFI the Greek Milsatcom satellite payload should include X, Ka-mil band and Q/V band for the feeder link to maximize throughput and spectrum efficiency considering also the coordination requirements with existing satellites operating in the overlapping bands and in the same coverage area in the neighborhood of 39 degrees East. Priority should be given in X band for user / feeder links with steerable multispot beams covering EMEA region. However, it is expected that Ka-mil will be used in parallel at least over Greece and North Mediterranean with small spot beams less than 0.8 beamwidth, so that coordination with neighboring satellites could be achieved. Q/V will be used only for the feeder link (as a priority). Other frequencies for the feeder link (X-band / Ka-mil) could also be considered by the system designer (for availability or other reasons).

Multi-Beam System: *While the RFI indicates the need for a multi-beam system, could you please specify how many beams the platform should be capable of supporting simultaneously?*

Multibeam satellite communications exploit the principle of frequency reuse to improve spectral efficiency thus maximizing the total throughput, as well as increase the systems physical layer security, while allowing higher availability over smaller sized terminals. What is more, multibeam systems further allow coordination and interoperability with existing communication satellites. The Greek MILSATCOM satellite, as described in the RFI, allows for multibeam solutions in the feeder and the user link. The feeder link is not expected to require a large number of beams, given the limited expected number of hubs (1-2). For the user link, the exact number of beams is left open to the system designer as it depends on multiple parameters, including but not limited to the minimum beam size, the maximum number of users per beam, the total satellite processing bandwidth and throughput, the achievable spectral efficiency and availability of the user ground segment and of course the total cost. However, an indicative number could be in the order of 6 (or a sufficient number to cover EMEA) for the X band, assuming spot size of less than 600 Km diameter and in the order of 10 (or a sufficient number to cover Greece & Cyprus / North & East Mediterranean) for the Ka-mil band, assuming spot size of less than 300Km in diameter and coverage over Greece & Cyprus / North & East Mediterranean. In Lat/Long terminology, the area of interest is in between 32 - 34deg North in Latitude and in between 19 - 33deg East in longitude. In Flight Information Regions (FIR) terminology, the area of interest is FIR Athens and FIR Cyprus.

Ground Terminals: *Will the ground terminals be provided by our company, or will they be sourced from another party? If the terminals are already in place, could you provide detailed specifications for them to ensure compatibility with our proposed information?*

The ground segment is part of the RFI. It is therefore expected to be quoted in the proposal of the consortium. A terminal population of up to 150 new terminals in X/Ka-mil bands is expected as mentioned in the RFI. In case the consortium is able to offer backwards compatibility to existing installed base of terminals (e.g. Ku band), this should be mentioned in the RFI response as a capability, along with the process to achieve the interoperability (e.g. upgrade to Ka-mil).

Operational: *Scenario Types? Homeland Defense? Expeditionary? Simultaneous Regions? Force Structure? Unit Types? Force Structure IER's? Connectivity to "Disadvantaged" Users? – Hi-Rate AISR connectivity? Threat Mitigation? Anticipated Threat Conditions? Does the military require operation though jamming? Options-Resilience vs Cost Trades? Coordination with other international partners?*

Scenario types shall include (but not limited to): Homeland Defense, Expeditionary over the EMEA region and Simultaneous Regions. Force structure shall be composed of (but not limited to):

Maritime and aero connectivity (e.g. >3 Frigates and associated force, airborne, etc.), Fixed & mobile backhauling terminals. Commercially available broadband solutions may be considered for high-rate connectivity of "disadvantaged" unclassified users. Hi-Rate Airborne Intelligence Surveillance & reconnaissance (AISR) connectivity could be considered given the capabilities of relevant forces (e.g. https://el.wikipedia.org/wiki/Lockheed_P-3_Orion, https://en.wikipedia.org/wiki/Boeing_E-3_Sentry, https://en.wikipedia.org/wiki/Boeing_P-8_Poseidon). Threat conditions include intentional RF interference as well as physical threats (e.g. missile attacks, non-cooperative in orbit threats etc.). **Anti-jamming is key aspect and mandatory feature**. Resilience vs Throughput tradeoff over a given cost should be elaborated. **Frequency coordination** over the congested **GEO** arc is **key aspect**.

System: *Evolvability? Software? Hardware? Spectrum and Orbital Location? Integration with national networks? Mission design life? Does the payload require channelization? If so, what frequency resolution is required/desired? Does the payload need to support on-board routing from user-to-user, without going through a gateway? Is in-band commanding (i.e. commanding in V or Ka-band) required for high bandwidth commanding (table uploads)? Or will all commanding occur out of band (e.g., S-band)?*

State of the art solutions including the principles of virtualization, network function orchestration, in a private cloud, that allow upgradability and interoperability with Terrestrial communication networks are highly welcome, but with proven security assurances. Ka-mil/X-band and Q/V for the GW in the neighborhood of 39E is the preferred option, but other orbital locations can also be considered assuming that there are the relevant ITU supporting filings with good ITU priority status. Ways to achieve interoperability with already deployed GW/terminals can be proposed, under the constraint that the military satellite shall not carry Ku band payloads. Multiple options for the mission design lifetime may be considered in the range of 8-20 years, as per Annex B of the RFI. Given the focus on medium/high-end terminals, a 5-10MHz channelization granularity is considered sufficient. Other alternatives in the performance vs cost tradeoff are also acceptable, given sufficient justification. User-terminal-to-user-terminal (UT-2-UT) communications is considered optional. However, the capability to install additional ad-hoc in-country gateways during operations, which allows local networks is desirable. The most secure option (in-band or out of band) for TT&C is desired (e.g. X or V band). Considering that the focus is on a digital transparent communication payload (DTP) rather than a fully regenerative payload with on-board signal demodulation, all technologically available secure TT&C options shall be considered.

Ground user segment: *Mainly aperture sizes to support the uplink/downlink data rates provided? Are all terminals of a given type a single, common polarization? Or will there be mixtures? Switchable? Spectrum information – which specific frequency ranges will there be access to?*

Aperture size shall depend on the frequency band, the terminal bandwidth, the achievable throughput and availability, the protected waveform capabilities of the terminal, the form factor and of course the cost. Realistically, given the focus on medium/high-end terminals, aperture sizes from 30cm for user terminals and above are expected, given the current evolutions of antenna technology. Innovative options with proven operation capability are welcome. Mix of terminal population as per RFI MIS-01. X-band/Ka-mil is a priority. More detailed frequency ranges to be proposed by the responder to achieve the overall system throughput and availability requirements. Please refer also to "FAQ – Ground terminals" for more information.

Gateway information (Ground GW segment)*:* *How many gateways are anticipated? Do you know the locations? Aperture size for the gateways? Spectrum access (how much bandwidth)? Are they simultaneous dual-polarization?*

1-2 GWs in total are expected. National (i.e. located in GR) for the primary is mandatory. The back-up can be anywhere. GW aperture sizes to be proposed by the responder given the satellite capabilities, chosen frequencies and end-to-end link budget and availability considerations. Minimum possible bandwidth to cover required throughput and anti-jamming requirements, given chosen by the responder waveforms with key attributes (spectral efficiency, low probability of detection/interception, frequency hopping etc.). Depending on satellite and terminal capabilities, operation in both polarizations is preferred in order to efficiently reuse the available spectrum over adjacent spot beams.

Concurrent military and commercial (Dual-use)*:* *Do we need physical separation of the military and commercial payloads? Does the military use a specific gateway?*

Clear operational separation between commercial (COMSATCOM) or governmental (GOVSATCOM) payloads is mandatory. Ways to achieve this shall be proposed. The current operational state of the military may not be disclosed. Separate GWs for different applications (COMSATCOM/GOVSATCOM/MILSATCOM) can be supported.