Initial Date (DD/MMM/YYYY): 14/02/2013
IP Number: 135
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Title: Zonal Analysis for Zones with different levels of Access.

Submitter: EASA, MRB Section

Additional / Detailed Information (Appendix to IP)

Details: So far MSG-3 states "*For a given zone, more than one task may be identified. In this case, the frequency of inspection is inversely proportional to the amount of access required; i.e., the more access required, the less the frequency of inspection.*"

"*Multiple zonal inspections may be identified for each zone with those having less frequent intervals requiring increased access requirements.*"

Currently the Zonal Inspection Requirements of different manufacturers are not well harmonized. Some manufacturers do only analyse zones at a specific level of access, and do only schedule a single zonal task requirement with that access requirement.

For example:
At least one manufacturer does only analyse the cabin/cargo/cockpit zones in fully stripped condition and does only schedule zonal tasks in this condition. Many items of the Zone are not inspected as they are removed before the inspection.
At least one manufacturer does analyse the cabin/cargo/cockpit zones in up to 3 different levels of access for standard/enhanced zonal analysis and after consolidation of requirements, schedules two zonal tasks at different levels of access with different interval.

This IP is not intended to add more ore more complicated/expensive tasks to an MRBR, it is intended to improve the analysis in order to avoid tasks with penalizing access requirements or low intervals which are not cost effective and add a risk of maintenance induced damage.
The analysis should identify the minimum requirements taking benefit of the already mentioned development of more than one task for a given zone, with the task interval being proportional to the amount of access required (i.e. to increase the interval for tasks with heavy access by meeting the minimum detection requirements through additional tasks with simple access at lower intervals).

The Issue identified does only affect a limited number of Zones.
Basically there are 4 different types of Zones:

- External Zones without Access Requirements
  (e.g. Radome External, readily inspectable)
- External Zones with Access Requirement to move certain control surfaces, high lift devices etc. to a specific position
  (e.g. Slats External, Access: Slats fully extended)
- Internal Zones with simple Access Requirement
  (e.g. Aft fuselage behind pressure bulkhead, Access: Hatch in lower skin)
- Internal Zones with multiple Access Requirements, which may exceed simple access doors/panels and require removal of items or partial disassembly. (e.g. Cargo Compartments)

The Issue only affects the fourth type, which for most aircraft is limited to internal zones in the 100 and 200 Major Zones, mainly the Flight Deck, the Passenger Compartment and the Cargo Compartment.

It should be noted that the number of Zones with multiple access requirements is highly depending on the manufacturers zonal breakdown. Some manufacturers already break down their aircraft to zones which mainly have a single access requirement (e.g. breaking down the zones in the cargo bay area into zones of the cargo bay, zones below the cargo floor and zones between cargo compartment side panels and fuselage skin) while other manufacturers break down each fuselage section into just 4 zones (above/below floor, left/right), so the areas in the cargo bay and the areas behind the cargo bay sidewalls do fall into the same zone.
Therefore the MSG-3 wording should take into account those options.

The picture on the following page gives an example of a typical zone in the passenger cabin area when the manufacturer does not break down zones further than above/below floor (Zone 100/200) and left/right (even/odd), in this case the area between the first and the second passenger door, right side, called Zone 224 as an example.

It demonstrates which items are all included within the volume defined by the Zone, and hence need to be covered by the Zonal analysis.

It also demonstrates how those items are accessible for inspection at different levels of disassembly, or in other words at different levels of access.

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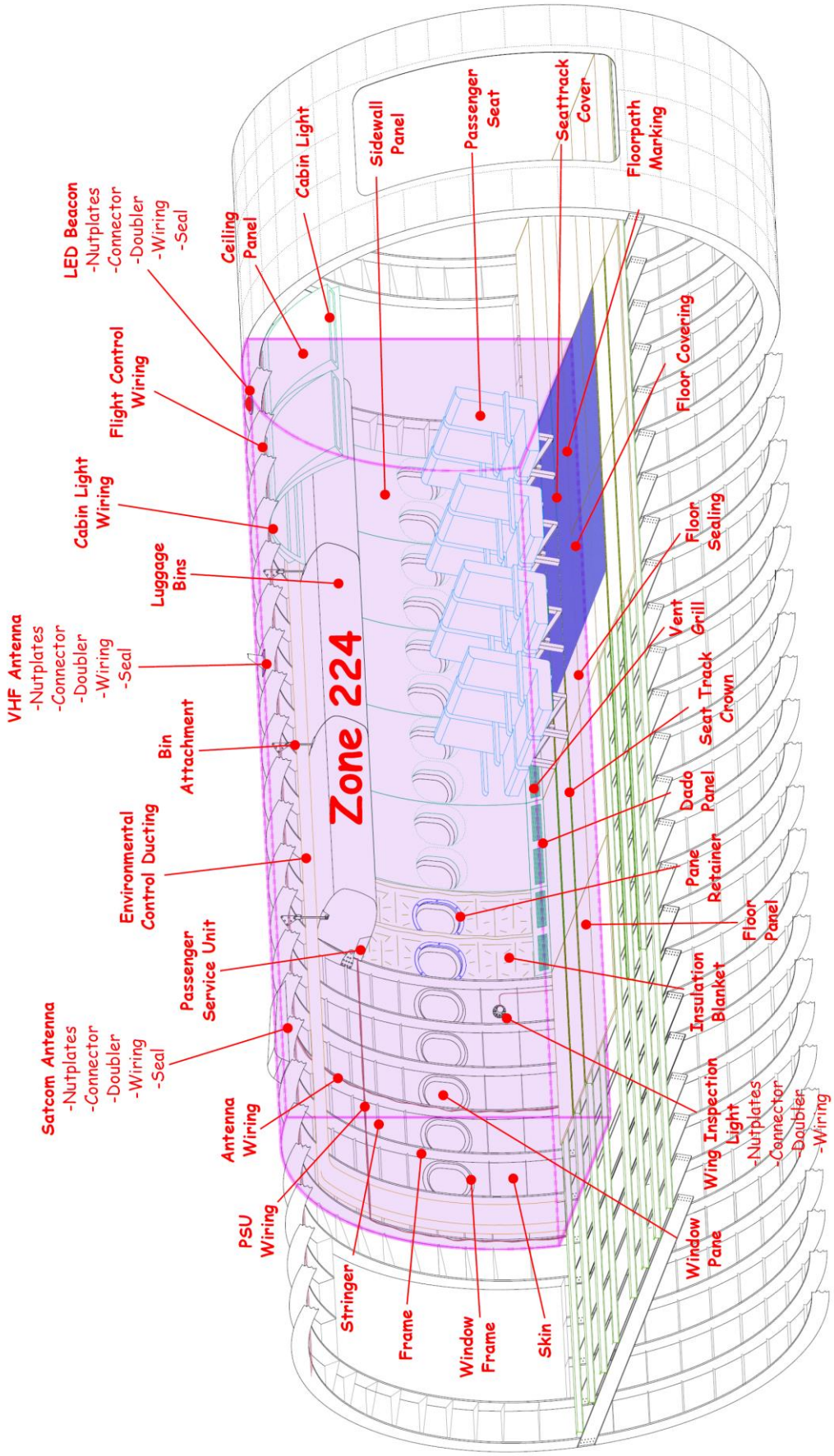


It is an important issue to make sure that any obvious damage, failure or irregularity of internal fuselage zones in service condition (access: Cabin door) is detected.

For example:

Frequently found corrosion damage to the cabin floor structure (causing costly repairs and hence having an economic impact, possibly also having a safety impact if structural integrity of the floor structure is necessary for the safety of the aircraft because flight control cables/wiring is running through it) might be avoided or significantly reduced if damage, failure or irregularity to the floor covering, sealing, door sill drainage etc. would be timely detected by a Zonal Inspection and subsequently repaired/restored before it causes damage to the structure.

Functional failure of electronic equipment installed below the cabin floor might be prevented if damage, failure or irregularity to piping, ducting, drip shields, seals, floor sealing etc. would be timely detected by a Zonal Inspection. There have been at least two serious recent incidents (2008, 2011) caused by fluid from the cabin entering an electronic compartment.

This illustrates that it is not only necessary to detect damage, failure or irregularity which becomes obvious after fully stripping a zone at high interval, but there is also the necessity to detect obvious damage, failure or irregularity which is readily visible when inspecting the Zone "as is" or with simple access requirements at a short interval.
Just inspecting a zone "fully stripped" basically just allows to transfer the structures GVI to this zone, but does not take care of all the items not covered through other analysis mentioned in MSG-3, *such as plumbing, ducting, Other Structure, wiring, etc.*

To meet the goal of MSG-3 *to maintain the inherent safety and reliability levels of the aircraft at a minimum total cost*, and to minimize the risk of maintenance induced accidental damage, it is important to only perform those inspections which are necessary at that point in time and to only gain access to those areas where it is needed for inspections and/or cleaning. On the other hand, each item and area within the aircraft which needs to be inspected and/or cleaned must be accessed at that point in time.

It is often not necessary to fully strip a zone, for example to clean the areas most susceptible to accumulation of combustible materials (dust, lint) in a cabin zone, it may be fully sufficient to remove the seats, floor covering and dado panels, but to leave all other linings in place if all items hidden by those linings are not susceptible to dirt accumulation and do not need to be inspected at that interval.
Especially for aircraft with large fuselage diameter, the zones or areas above the luggage bins might by fully inspectable within arms length by just removing ceiling panels and use of a ladder, so removal of the bins might not be required to perform the according zonal inspection.

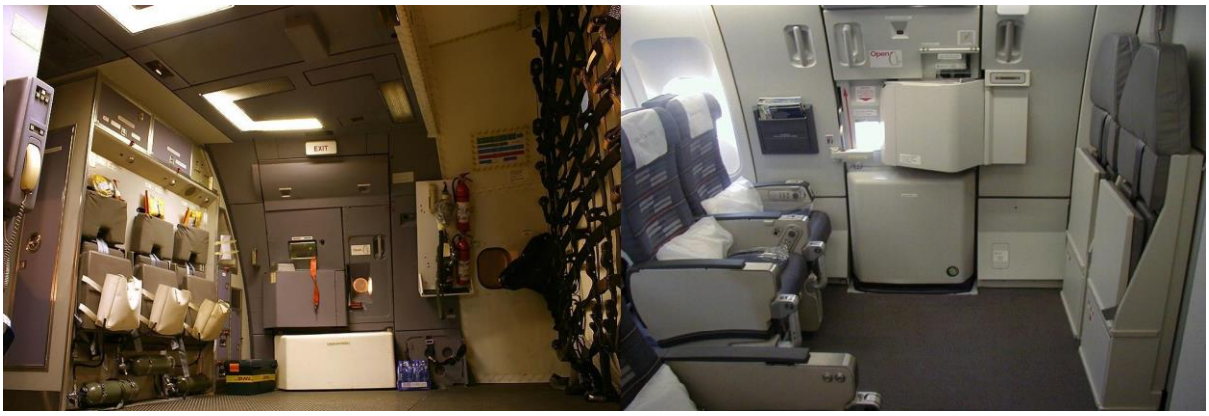
Quite naturally the Zonal rating systems will result in higher intervals for the higher access requirements, as the items behind fairings, linings, insulation etc. will be protected better from accidental damage and the environment, will be less frequently visited, and the visibility will become better and congestion lower the more items you remove. This is already reflected in the current MSG-3 wording, however there might be some zones where this does not apply, mainly due to the fact that more combustible material can accumulate behind fairings, lining, insulation and items, and that EWIS is typically installed behind, and not on top of them. Finally it will depend on the individual design of the aircraft and the rating system whether the intervals resulting from the analysis will automatically be proportional to the level of access.
The MSG-3 wording should be improved to take this into account.

The Standard Zonal Rating System / Enhanced Zonal Rating System may result in the same interval for different levels of access, in that case separate Zonal tasks with different access are not required, and only a single consolidated Zonal Inspection requirement needs to be defined with the higher level of access.

It may be found as well during the analysis that a certain level of access does only add items to the analysis which are already covered by Structures, Systems/Powerplant or L/HIRF analysis, so no Zonal Task is required for them and hence no additional Zonal analysis is required at this level of access.

For the highest possible access level (zone fully stripped, all insulation blankets removed) the MSG-3 logic will often result in a "No Task", as anything within the zone requiring it to be fully stripped to access it, is structure already covered by SSI analysis and according tasks in the MRBR Structures Section and/or PSE analysis and according tasks in the Airworthiness Limitation Section. Therefore, depending on the dedicated analysis, no Zonal Task with this high access level might be required.

The Following examples should illustrate the issue



Example 1: Cabin zones "as is" accessed through the cabin door

Many items are visible to detect obvious damage, failure or irregularity by just accessing the Zone.

Typical examples for Zonal findings at this level of access:

- Accidental damage to cabin interior caused by catering trolleys, carry on luggage etc.
- Deteriorated or missing placards and markings
- Loose or missing equipment
- Deterioration or damage to floor covering, and floor sealing
- Stains, discoloration etc. indicating spillage events
- Contaminated/blocked/damaged drains

Example 2: Cabin zones with seats and galleys/lavatories removed

Many items are available for a GVI after removal of the passenger seats and floor covering.

Typical examples for Zonal findings at this level of access:

- Corrosion or accidental damage to the seat rails or galley/toilet attachment points
- Loose or broken dado panels and vent grills
- Loose or damaged passenger service units, luggage bins or sidewall lining
- Loose or damaged floor panels, damaged or missing floor sealing

Example 3: Cabin zones with interior and lining partly removed

Many piping, ducting, wiring, other structures, insulation blankets etc. is available for a GVI after removal of the floor covering, sidewall linings, ceiling panels and some of the bins.

Typical examples for Zonal findings at this level of access:

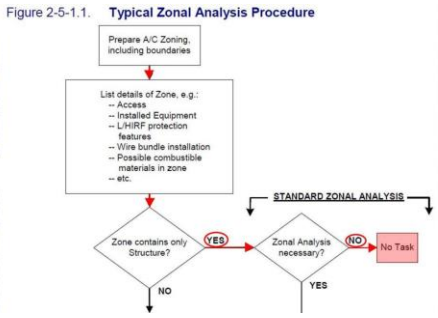
- Corroded, cracked or accidentally damaged structures (mainly other structures and support items)
- Contamination of cabin interior items (bins, lining etc.)
- Damaged, leaking, chafing, loose piping and ducting
- Damaged, loose, corroded, chafing flight control cables, worn cable guides

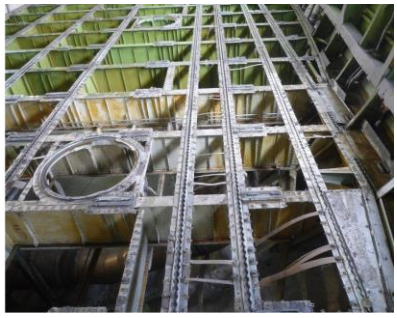
Example 4: Cabin zone with interior and lining fully removed

Piping, ducting, wiring, other structures, insulation blankets etc. visible for a Zonal inspection

Typical examples for Zonal findings at this level of access:

- Damaged, loose or contaminated, discoloured insulation blankets indicating overheat, leakage, spill events
- Damaged, leaking, chafing, loose piping and ducting
- Damaged, loose, corroded, chafing flight control cables, worn cable guides





Example 5: Cabin zone fully stripped

If the zone contains only structure at this level of access, no according zonal task might be required

Typical examples for Zonal findings at this level of access:

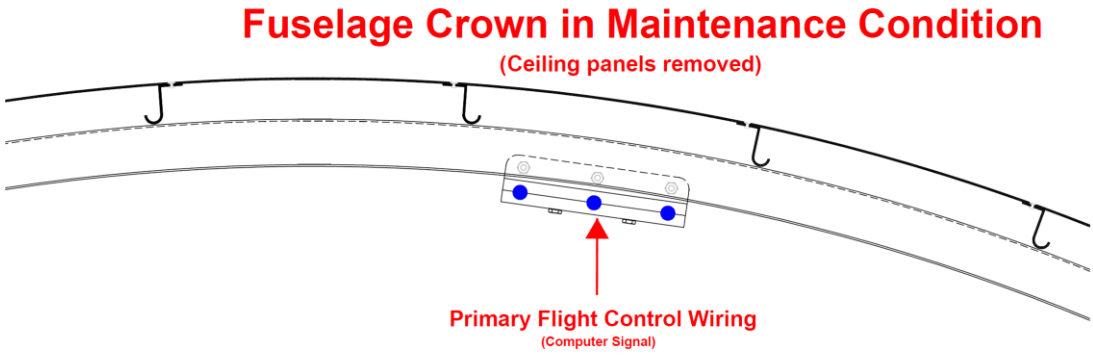
- Corrosion, cracking or accidental damage to structure
- Loose or missing fasteners
- Deterioration of paint/primer
- Blocked drain paths (drainholes, slots, gaps)

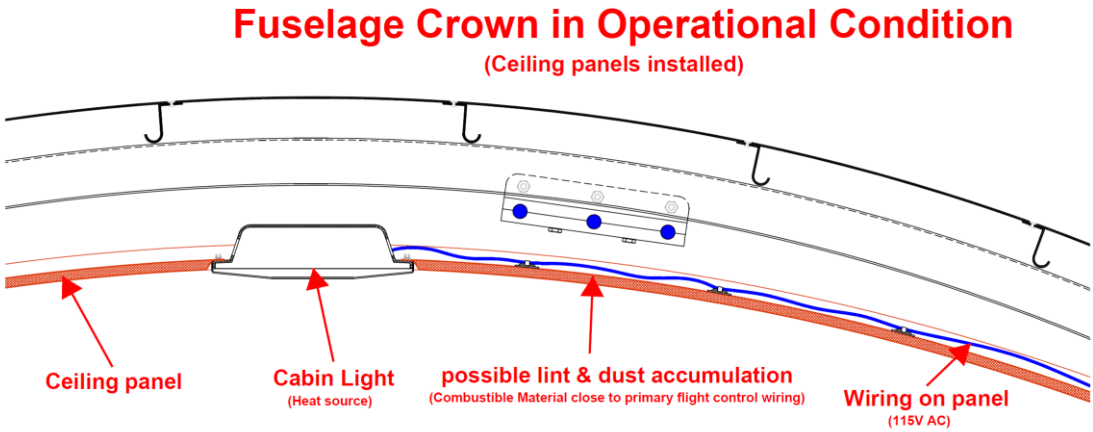
It should be clear that any item within the volume defined by an internal zone, as well as any item constituting physical boundaries of a zone needs to be covered by the MSG-3 analysis, either through dedicated systems, powerplant, structures or L/HIRF analysis, or through standard or enhanced zonal analysis procedures. The result of this analysis may however show that no task is required for certain items and accordingly no task is required at a certain level of access.
In the past often a zone has only been analysed and an according zonal inspection has only been created for one single level of access, i.e. items removed for access to this level have not been taken into account, as well as items not visible at that level of access.
For example cabin zones have only been analysed and inspected with seats, galleys, lavatories, bins (including PSUs), lining and floor covering removed, but with insulation blankets, wiring, ducting, piping still in place.

It is common practice that the cabin interior is not removed by inspectors, but by mechanics. Therefore any item removed before the actual inspection might not be inspected at all.
Also certain items removed for inspection (e.g. luggage bins, air conditioning ducts) might not be inspected for condition and secure attachment by zonal inspection, but by AMM procedure during closeout after inspection.

The enhanced zonal analysis should be able to for example detect EWIS of the cabin lights installed to ceiling panels on which dust and lint can accumulate, which are located just below primary flight control wiring installed to the upper fuselage panel structure.

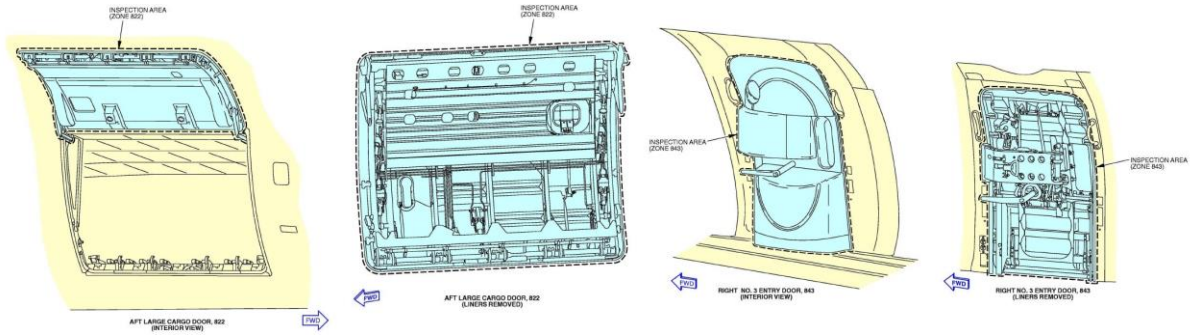
Therefore it is important that the zonal analysis takes into account the zone in operational condition with all items installed (i.e. linings, fairing, access panels, insulation blankets etc.) when rating likelihood of accidental damage (except for damage due to maintenance), environmental deterioration, accumulation of combustible material, density of equipment, wiring and other EWIS. On the other hand, likelihood of accidental damage due to maintenance, accessibility, size of the zone, congestion or visibility should be rated in maintenance condition.



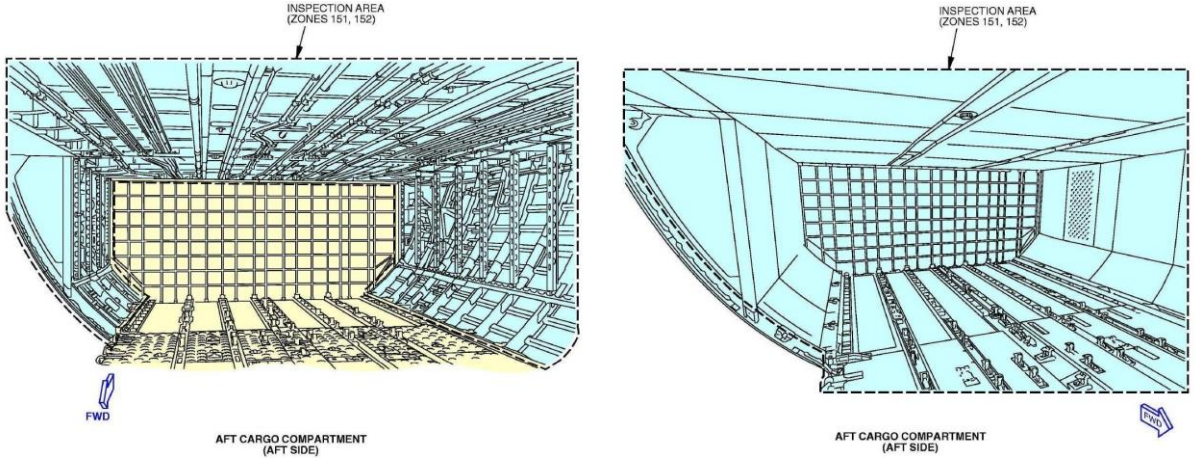


Currently a lot of the inspections and the cleaning, normally part of the zonal tasks resulting from the zonal analysis, is in fact done during zonal inspection preparation/closeout through AMM procedures outside of the control of the MRB process. Basically this is acceptable just like some checks required for systems are done by the flight crew through AFM procedures, but it needs to be taken into account during the zonal analysis just like it is done during the systems analysis. If for example a "clean as you go" philosophy (as mentioned in FAA AC25-27A, EASA AMC 20-21) is systematically established in the AMM, no additional cleaning task to reduce the likelihood of combustible material accumulation is required for all those items removed for access or inspected through the standard zonal GVI.

Currently some manufacturers do already schedule more than one zonal task at different levels of acces, the following examples show zonal GVI at two different levels of access.



Example 6: Cargo/Passenger Door Zones 822, 843 internal
Zonal inspection tasks scheduled at two levels of access, "as is" and with door lining removed



Example 7: Cargo Compartment Zones 151/152 internal
Zonal inspection tasks at two levels of access, "as is" and with sidewall/ceiling lining removed

It should be the standard for a zonal analysis to determine at how many different levels of access zonal GVI have to be scheduled.
The result of that analysis may of course show, that a single level of access is fully appropriate to maintain the inherent safety and reliability of all items located within a zone and to accept all task transfers from systems/powerplant, structures or L/HIRF.
It may however also demonstrate that the goal of MSG-3 can only be reached if several zonal GVI at different levels of access and different intervals are selected.