

Aero services – I-3 to I-4 migration

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1. Introduction

Three of the four Inmarsat I-3 satellites are coming to their end of service life. Inmarsat has committed to continue a number of services which currently are provided through the I-3 satellite constellation. These services must be migrated onto the I-4 satellites.

The migration is planned to take place during the course of 2018 in order to perform an orderly migration off all but one of the I-3 satellites and ensure a continuation of selected services.

This document provides details on the migration of each of the impacted Aero services and on actions to be taken to ensure a smooth transition.

Note: in this document, Ground Earth Station (GES) will also be used for Land Earth Station (LES) and the generic term 'Bulletin Board (BB)' is also used to describe the Classic Aero System Table.

2. I-3 to I-4 migration description

2.1. Background

The migration plan as currently defined is based on the feedback from the consultation with aviation user terminal (UT) manufacturers, carried out over the past 18 months. The main purpose of this consultation was to 'fine-tune' the migration plan to minimise the impact on terminals with a particular focus on Classic Aero services.

UT manufacturers have provided feedback regarding the content of the system tables and the chronology of the migration based on their experience and knowledge of the terminal behaviour.

2.2. Migration Sequence

The migration will take place in 4 steps, as listed below.

- Step 1: Move of AORW from the 3F5 satellite (54° W) to the 4F3 satellite (98° W).
- Step 2: Move of POR from the 3F3 satellite (178° E) to the 4F1 satellite (143.5° E).
- Step 3: Move of AORE from the 3F2 satellite (15.5° W) to the 3F5 satellite (54° W).
- Step 4: Move of IOR from the 3F1 satellite (64° E) to the AF1 satellite (25° E).

The resulting network configuration will consist of three I-4 satellites (4F1 (APAC), 4F3 (AMER), AF1 (EMEA) and one I-3 satellite 3F5 (AORE).

Exact dates and times for each of the migration steps will be provided in a separate communication.

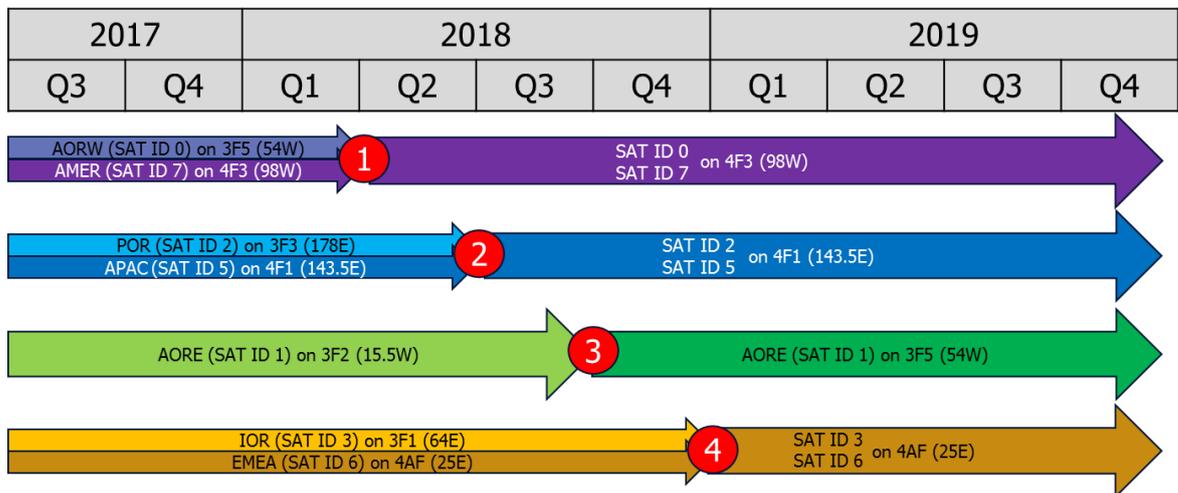


Figure 1: overview of the I-3 to I-4 migration sequence and timelines

2.3. Key Facts

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- The SAT IDs and Ground Earth Station (GES)/Land Earth Station (LES) IDs will remain the same for Classic Aero and Swift64 services, although the I-3 satellite longitudes will be amended: effectively the coverage or footprint of the AORW, AORE, IOR and POR will move to the west. In addition, the coverage area of the IOR will change, due to the special footprint of the AF1 (AlphaSat) satellite.
 - The existing I-3 satellite IDs and GES IDs will be hosted on the I-4 satellites so that the I-3s appear as separate satellites to the terminals, which will be known as "Virtual I-3s on I-4". The objective is to create a "virtual I-3 satellite" configuration on the physical I-4 satellites, to offer a seamless migration to the terminal used to operating on the I-3s and thus avoid any manual intervention to terminals post the migration. Using this approach, an I-3 only terminal should be able to operate similarly to the way it operated over the I-3 satellites prior to the migration, provided that the terminal in question has received the updated bulletin board with the new longitude information and is able to point towards the correct satellite.
 - I3 GESs operating over the I-4 will also use synthesised regional beams mimicking the regional beams over I-3 and limiting the number of regional beams below 6/7. The Classic Aero and SBB services currently operating on the I-4s and Alphasat will remain unchanged.
 - Classic Aero-H and –H+ services will both be provided on both the Virtual I-3 configurations and the original I-4s.
 - Classic Aero-I voice service will be provided in the Global Beam using Engineering Fallback Mode.
 - The restriction in the ground network which prevents certain terminals logging on to the current Classic Aero I-4 GESs will be removed.
 - MTSAT bulletin boards will be updated at each step of migration.
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2.4. Coverage at each migration step

The figures below provide a graphical view of the changing footprints of the 4 Ocean Regions. The dashed contour is the footprint before the migration. The solid contour is the footprint after the migration. In Annex 2 the combined footprints of all ocean regions are shown before and after migration.

2.4.1. Before migration

The I-3 constellation consists of 4 I-3 satellites:

- Atlantic Ocean Region – West (AORW) on the 3F5 satellite at 54° W
- Atlantic Ocean Region – East (AORE) on the 3F2 satellite at 15.5 ° W
- Indian Ocean Region (IOR) on the 3F1 satellite at 64 ° E
- Pacific Ocean Region (POR) at 3F3 satellite at 178 ° E

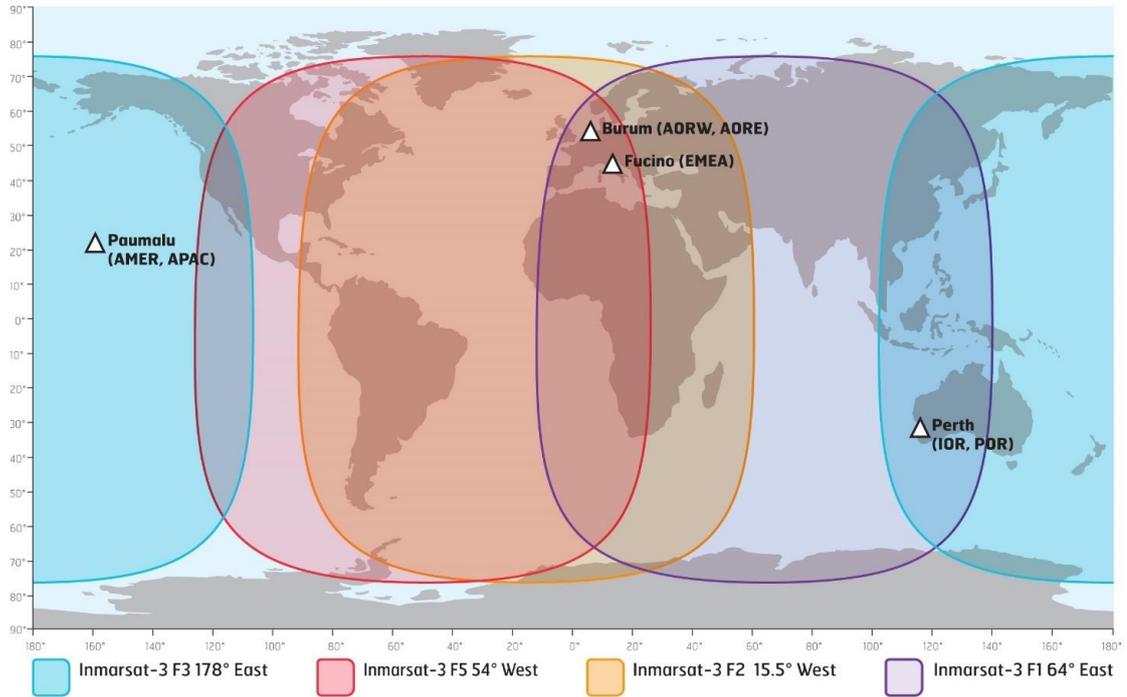


Figure 2: I-3 satellite coverage map before migration

2.4.2. Step 1: Closure of AORW and migration to AMER

SAT IDs and GES IDs associated to AORW will be moved from the 3F5 satellite to the 4F3 satellite.

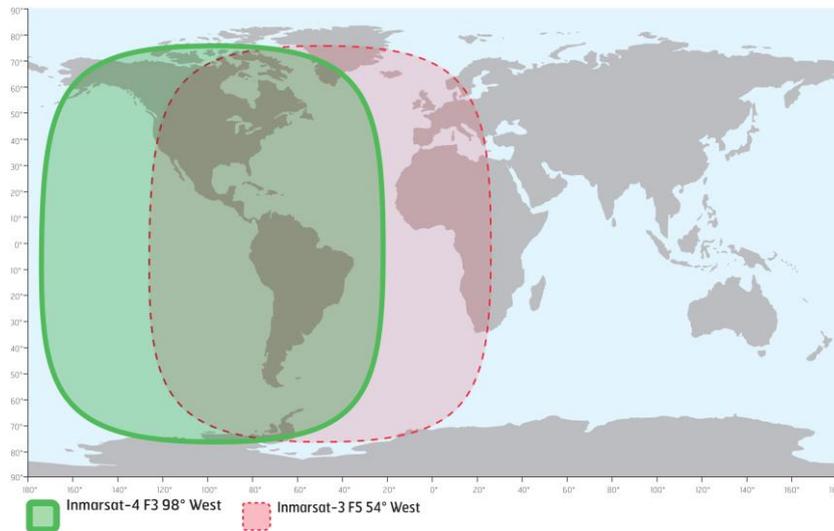


Figure 3: Step 1 - AORW migration from 54° W (3F5) to 98° W (4F3)

2.4.3. Step 2: Closure of POR and migration to APAC

SAT IDs and GES IDs associated to POR will be moved from the 3F3 satellite to the 4F1 satellite.

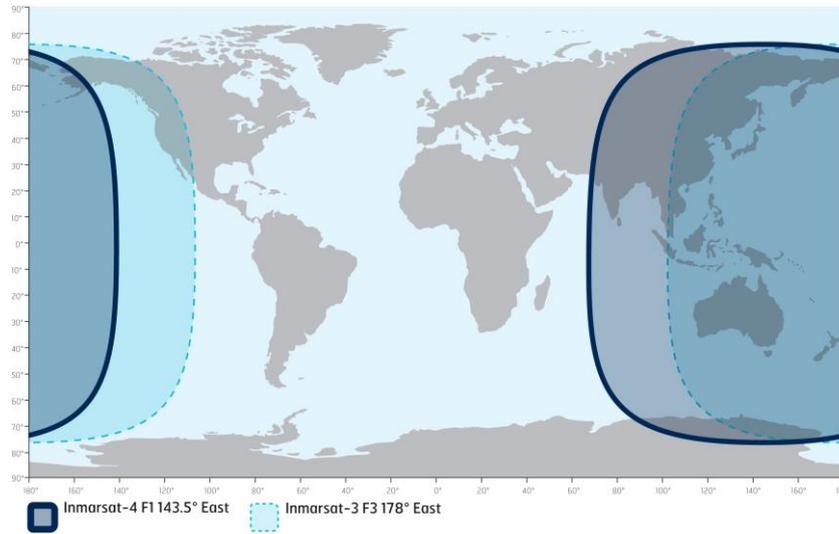


Figure 4: Step 2 - POR migration from 178° E (3F3) to 143.5° E (4F1)

2.4.4. Step 3: Move of AORE from 15.5W to 54W

SAT IDs and GES IDs associated to AORE will be moved from the 3F2 satellite to the 3F5 satellite.

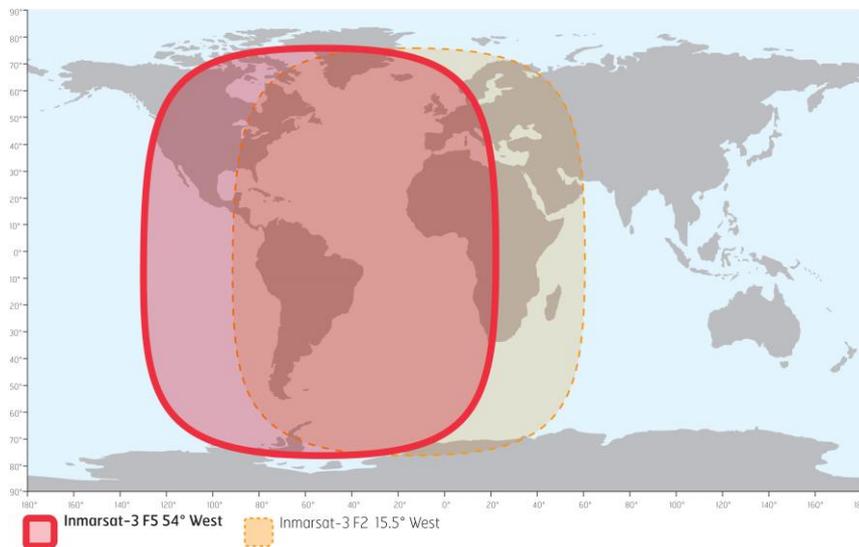


Figure 5: Step 3 - AORE migration from 15.5° W (3F2) to 54° W (3F5)

2.4.5. Step 4: Closure of IOR and migration to EMEA

SAT IDs and GES IDs associated to IOR will be moved from the 3F1 satellite to the AF1 satellite.

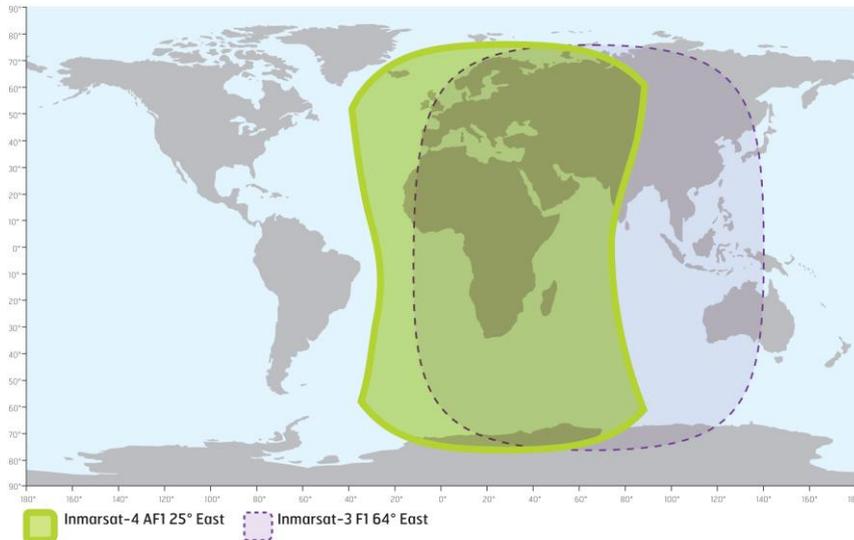


Figure 6: Step 4 – IOR migration from 64° E (3F1) to 25° E (AF1)

2.5. E&E coverage map after migration

The post-migration E&E services coverage map consists of 4 satellites:

- 3F5 satellite at 54° W
- AF1 satellite at 25° E
- 4F1 satellite at 143.5° E
- 4F3 satellite at 98° W

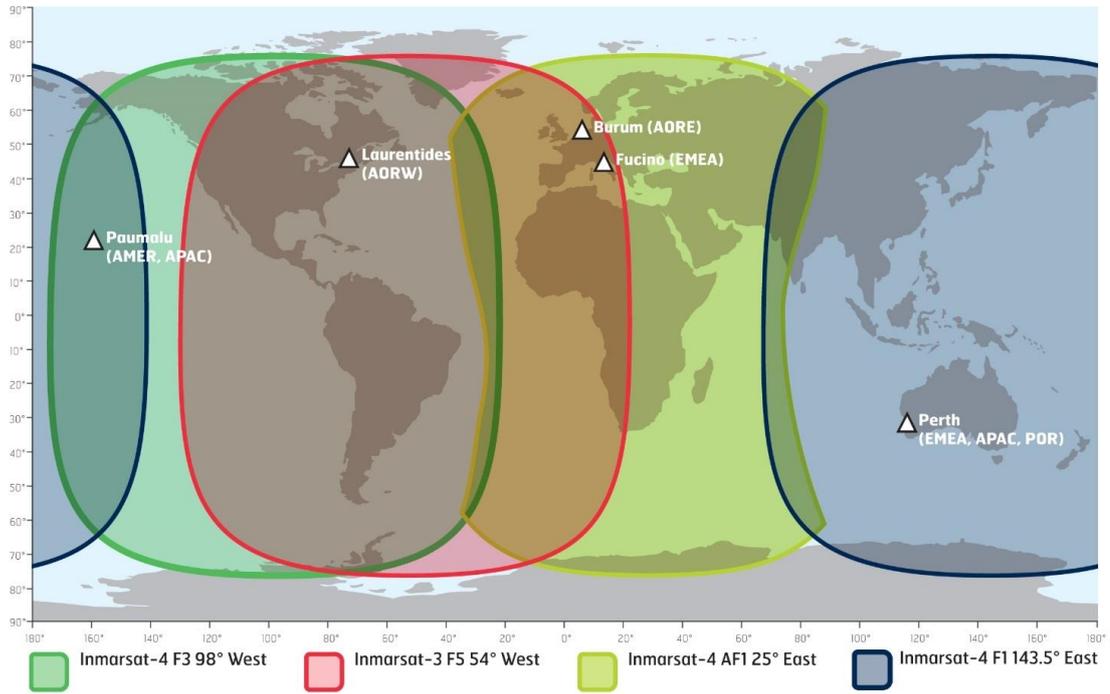


Figure 7: Post-migration E&E coverage map

2.6. Satellite contingency

After the migration, the contingency plan for each of the satellites now supporting E&E services is detailed below.

Prime Satellite failure	E&E Region	Contingency Satellite
4A1/Alphasat (25E)	EMEA	3F1 (64E)
3F5 (54W)	AORE	4A1/Alphasat (25E)
4F1 (143.5E)	APAC	3F3 (178E)
4F3 (98W)	AMER	3F3 (178E)

Table 1: satellite contingency after completion of migration

2.7. Spot beam management

2.7.1. I-4 spot-beam management

I-4 satellite configuration will be unchanged with identical spot-beam management to that currently in place.

2.7.2. I-3 spot-beam management

I-3 satellite spot beam configuration will be duplicated on I-4 satellites, using the synthesised spot-beam capability of the I-4 satellites.

3. Impact of the migration

3.1. Impact on E&E services

Although all efforts have been made to ensure all services are supported a similar way to that prior to the migration, some limitations exist in the new satellite configuration.

Information on how each of the impacted services is affected is provided below.

3.1.1. Swift64 services

Swift64 capacity will be provided in all regional spot-beams on the I-4 satellites, but capacity for E&E services on these satellites might be constrained by the demands of other I-4 services. Post-migration traffic analysis will be performed to identify those beams where capacity changes are required (either more capacity in case of congestion, or less capacity in case of under-utilisation).

MPDS services will not be transferred over to the I-4 satellites:

- Global MPDS availability is not guaranteed after the **31st of March 2018**.
- MPDS will be supported in each I-3 region until that satellite is migrated. MPDS service will close in AORE when that region is migrated onto the 3F5 satellite, even though the destination satellite is an I-3.
- No MPDS services will be provided after the end of 2018.

3.1.2. Aero-C services

Aero-C services will be migrated onto the new satellite at the same time as the maritime Inm-C service. Following this they will migrate similarly at each migration step. The schedule information will be updated at <https://www.inmarsat.com/support/i-3-to-i-4-services-migration/>

Migration schedules will be provided in separate communications.

3.1.3. Classic Aero services

For Aero-I customers, voice channels will be supported in global beam instead of spot beams.

Engineering FallBack Mode (EFM) will be enabled in the 'virtual I-3' ocean regions.

3.2. Impact on terminals

3.2.1. Swift64 terminals

Category 'B' Swift64 terminals will **be supported for a limited period after the first migration**. Inmarsat has been working with Swift64 manufacturers for many years to upgrade MES Category 'B' terminals to MES Category 'A' and SBs have been available for a long time, please refer customers to the Honeywell and Cobham portals for more information (see below) Inmarsat will issue adequate notice before the removal of the Category B frequency pool.

3.2.2. Aero-C terminals

The impact of the migration on Aero-C terminals is described in the guide available on the Inmarsat website: <https://www.inmarsat.com/support/i-3-to-i-4-services-migration/>

3.2.3. Classic Aero terminals

The issue of older versions of terminals not allowing operations with 19 spot beams (which is standard I-4 operation) is currently being addressed:

- Users with terminals affected by this issue should refer to the relevant UT manufacturer portal for further details.
- The I-3 beam mapping will be maintained on the physical I-4 satellites as described in paragraph 2.7.2.

For terminals capable of handling 19 spot beams, some UT manufacturers recommend that users amend the ORT on the terminal to allow operations with I-4 GES/LESs (please refer to the relevant UT manufacturer portal for further details).

3.2.4. Impact by terminal model

Although the majority of the terminals are not expected to encounter any issue during migration, as long as they get the updated system tables and record the new longitude information, some may require manual intervention as either a proactive, corrective or reactive action.

Service Information Letters (SILs) have been issued for the impacted terminals and are available on the terminal manufacturers' portals. The link to these portals are given below.

Additional documents maybe released prior to the first migration step and it is advised to check the relevant UT manufacturers' portals on a regular basis for updated information.

3.2.4.1. Cobham

Any document related to this migration is available on the Cobham portal: <https://sync.cobham.com/satcom/>

3.2.4.2. Honeywell

Any document related to this migration is available on the Honeywell portal: <https://myaerospace.com/>

3.2.4.3. Rockwell-Collins

Any document related to this migration is available on the RCI portal: <https://www.shopcollins.com>

3.2.4.4. Thales

Any document related to this migration is available on the Thales portal: <https://www.thalesgroup.com/en/customer-online>.

4. Way Forward

4.1. In preparation for the migration

End users are advised to implement the SILs relevant to their fleet.

Migration information is available on the inmarsat.com website:
<https://www.inmarsat.com/support/i-3-to-i-4-services-migration/>

4.2. During each step of the migration

It is advised to leave the terminal on and connected to the Inmarsat network in order to receive and record the new bulletin boards.

4.3. After migration

If the terminal was switched off during the migration and has not received an updated bulletin board, please refer to relevant the SILs in section 3.2.4 above.

4.4. Contingency plan

Inmarsat will closely monitor the traffic before, during and after each step of the migration.

In the case where a major issue is found that affects network performance, Inmarsat reserves the right to roll back the network configuration: further communication will be provided, should any issue be observed.

ANNEX 1: Acronyms

The acronyms shown below are used in this document.

Acronym	Meaning
AMER	Americas Ocean Region, operated by I-4 satellite located at 98W
AORE	Atlantic Ocean Region East, operated by I-3 satellite located at 15.5W
AORW	Atlantic Ocean Region West, operated by I-3 satellite located at 54W
APAC	Asia/Pacific Ocean Region, operated by I-4 satellite located at 143.5E
CIL	Customer Information Letter
CN	Change Notice
EMEA	Europe/Middle East Ocean Region, operated by I-4 (AlphaSat) satellite located at 25E
GES	Ground Earth Station
IOR	Indian Ocean Region, operated by I-3 satellite located at 64E
LES	Land Earth Station
LESO	Land Earth Station Operator
MEAS	Middle East/Asia Ocean Region, operated by I-4 satellite located at 64E
NCS	Network Coordination Station
ORT	Owners Requirements Table
POR	Pacific Ocean Region
PSA	Point of Service Activation
PSID	P-channel Satellite ID
SAM	Standalone Mode
SB	Service Bulletin
SIL	Service Information Letter
UT	User Terminal

ANNEX 2: Ocean Region footprints

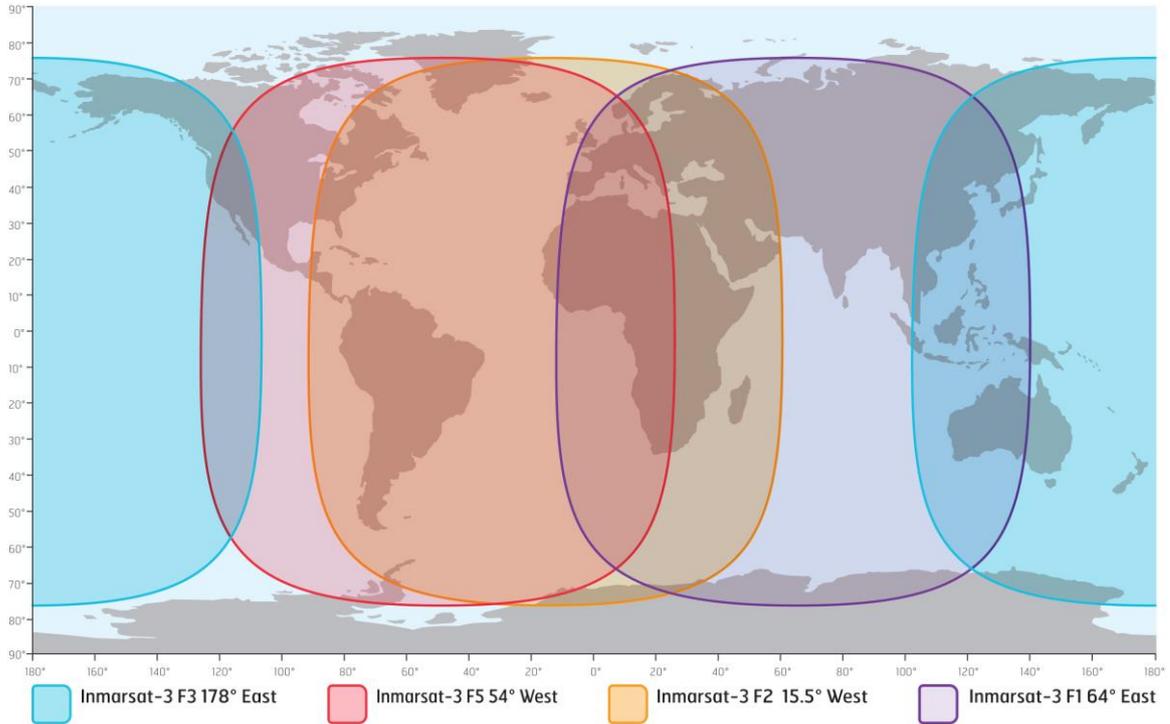


Figure 8: 13 Ocean region footprints before migration

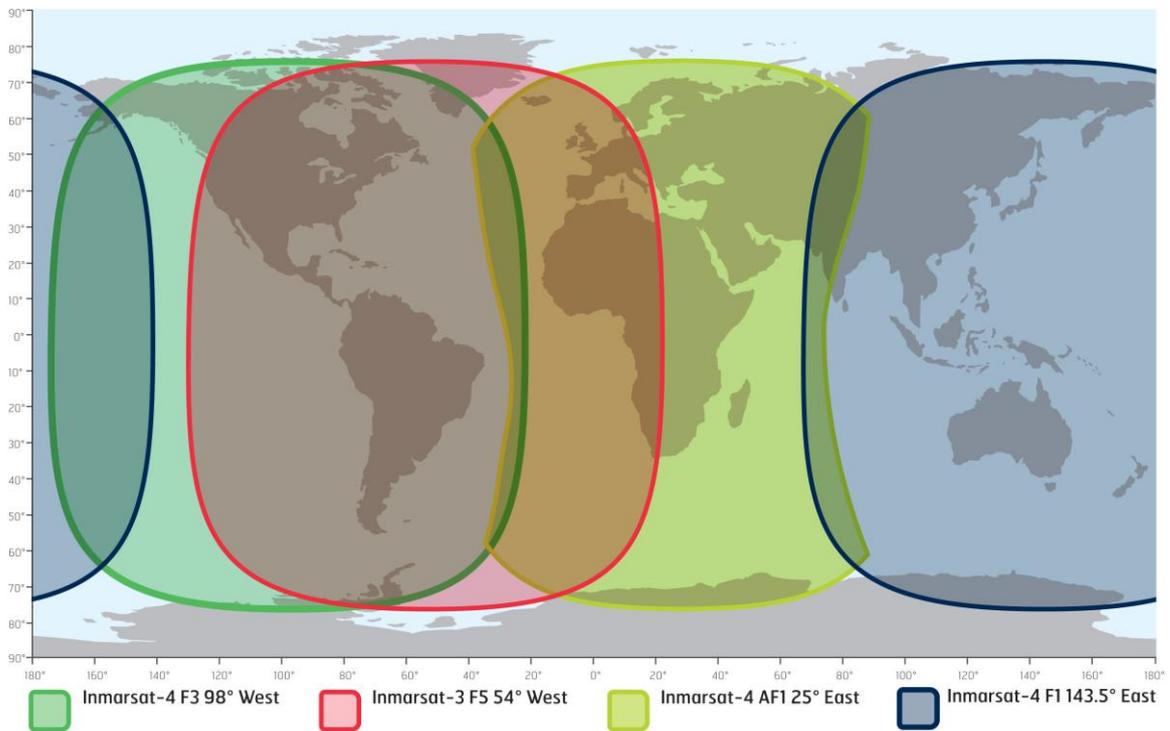


Figure 9: Ocean region footprints after step 4 of the migration