SES Americom, Inc.
Accelerated C-band Transition Implementation Plan

On June 1, 2020, the Commission's Wireless Telecommunications Bureau ("Bureau") confirmed that a sufficient number of eligible space station operators filed accelerated relocation elections, triggering the accelerated relocation of the 3700-4000 MHz band pursuant to the accelerated clearing schedule set out in the Report and Order issued in the C-band proceeding.[1]

By electing to accelerate clearing, SES committed to relocating its services and the associated Incumbent Earth Stations out of the lower 300 MHz per the below schedule:

Phase I: By December 5, 2021, SES will:

- Relocate all of its commercial services out of the 3700-3820 MHz band exclusive to the contiguous United States ("CONUS");[2]
- Make necessary equipment changes on all associated Incumbent Earth Stations located in 46 of the top 50 Partial Economic Areas ("PEAs") and the surrounding areas in CONUS;[3]
- Supplement its telemetry, tracking and control ("TT&C") operations to enhance two earth stations located in Hawley, PA ("Hawley"), and Brewster, WA ("Brewster") (collectively, "TT&C/Gateway") to comply with the *C-Band R&O*;[4] and
- Begin to consolidate its gateway services (*e.g.*, international feeder link, data, and other services) currently located at other SES gateway locations as well as any

[1] *Wireless Telecommunications Bureau Announces Accelerated Clearing in the 3.7-4.2 GHz Band*, Public Notice, GN Docket No. 18-122, DA 20-578 (WTB rel. June 1, 2020); *see also Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Report and Order and Order of Proposed Modification, 35 FCC Rcd 2343 (2020) ("*C-Band R&O*").

[2] A certain number of services, most notably from SES's international satellite fleet, will continue to be downlinked in the 3700-3820 MHz band into CONUS. These services will be received at the Hawley or Brewster teleports in accordance with the Commission's rules and *C-Band R&O*. 47 C.F.R. § 25.203(n); *C-Band R&O* ¶¶ 379-81. Some services will also be received at SES's teleports in Manassas, VA and Woodbine, MD between the Phase I and Phase II clearing deadlines. The continued limited operations in the 3700-3820 MHz band at the Woodbine and Manassas facilities will not impact the introduction of 3.7 GHz Services because both teleports are located in PEA 5, which is not subject to clearing in Phase I. To the extent necessary, SES will seek a waiver to continue unprotected international gateway operations at the Woodbine and Manassas facilities until the Phase II deadline.

[3] *See* 47 C.F.R. § 27.1411(b)(5) (defining "Earth station filtering").

[4] *C-Band R&O* ¶ 375.

customer or user gateway services to Hawley and/or Brewster; these gateway services will operate on an unprotected basis in the 3700-3820 MHz band.[5]

Phase II: By December 5, 2023, SES will:

- Relocate all of its CONUS-exclusive commercial services out of the 3700-4000 MHz band;[6]
- Make necessary equipment changes on all associated Incumbent Earth Stations located in all CONUS PEAs;
- Continue TT&C operations in the lower portion of the band on a protected basis at the TT&C/Gateway sites and in the upper portion (4.2 GHz) of the band at SES's other teleports for existing and new satellites; and
- Complete gateway consolidation to the TT&C/Gateway sites; the gateway services will operate on an unprotected basis in the 3700-4000 MHz band at the TT&C/Gateway sites.

The transition implementation plan described below ("Transition Plan") details the substantial, complex steps SES must take to meet its commitments in coordination with its customers and associated Incumbent Earth Stations.

This plan has been communicated to all of SES's U.S. C-band customers that have services received from SES within CONUS. SES has been extensively engaged with its customers and other C-band stakeholders for two years to develop this Transition Plan. Since 2018, SES has held numerous meetings with its customers to understand their capacity needs now and in the future. SES also held numerous monthly joint meetings with Intelsat over the course of 2018 and 2019 to provide updates on the developing plans for customers, cable operators, installers and other interested stakeholders. On two occasions (in September 2018 and April 2019), SES and Intelsat held joint in-person meetings with customers, MVPDs, and other earth station operators to demonstrate the capabilities of the filters SES and Intelsat jointly developed (*i.e.*, while receiving satellite signals in the presence of 5G interference) as well as to discuss other elements of the planned transition. Webinars were held with industry groups such as ACA Connects and the National Association of Broadcasters ("NAB") to make their members aware of the impact of the C-band clearing on their operations and the importance of registering their antennas with the International Bureau. At numerous industry conferences and tradeshows, such as SCTE Cable-Tec, the NCTC WEC, the NAB Radio Show, the NAB Show, the Mid-America Cable Show and the ACA Summit, SES had a presence and discussed the C-band clearing, filters and related activities with numerous earth station operators to obtain their feedback. SES has

[5] *See supra* note 2.

[6] *See supra* note 2.

also engaged in numerous direct one-on-one discussions with MVPDs seeking detailed input on the impacts of clearing at MVPD earth stations.

Since the adoption of the *C-Band R&O*, a multi-stakeholder group comprising "incumbent earth stations (including MVPDs and broadcasters), incumbent space station operators, wireless network operators, network equipment manufacturers, and aeronautical radionavigation equipment manufacturers" has formed to "provide valuable insight into the complex coexistence issues in [the C-Band] and provide a forum for the industry to work cooperatively towards efficient technical solutions to these issues."[7] SES presented its initial Transition Plan (filed June 19, 2020) to Technical Working Group #2 of the Industry Multi-Stakeholder Group on June 26, 2020 to seek industry input. SES and Intelsat also presented the passband filter specification and provided an update on filter production to the Technical Working Group #1 of the Industry Multi-Stakeholder Group. The collective input received from years of extensive discussions, webinars, demonstrations, and industry conferences has led to the development of this Transition Plan. SES has made commercially reasonable efforts to incorporate customers' individualized needs but developed this Transition Plan primarily to ensure the completion of accelerated relocation within the deadlines set forth in the *C-Band R&O*, with minimal impact to customers and within a reasonable cost.

I. Details of Transition

A. Existing Space Stations Subject to Transition (§ 27.1412(d)(1)(i))

SES has been providing C-band service in the United States for over 40 years and was instrumental in developing the resilient and cost-effective television and audio distribution and data network ecosystems that relies on C-band satellite service today. In developing this vibrant satellite ecosystem, SES has procured and launched dozens of satellites. Sixteen such satellites are in service today with satellite services that could be impacted by the clearing of the 3700-4000 MHz band.

The Commission's rules require transition plans to list "[a]ll existing space stations with operations that will need to be transitioned to operations above 4000 MHz."[8] SES understands that this would include any satellite that is intentionally downlinking in the 3.7-4.0 GHz band to earth stations in CONUS.[9] SES also understands that this includes any other space station transition activities necessary for SES to cease downlinking to CONUS in the 3.7-4.0 GHz band

[7] *C-Band R&O* ¶ 333.

[8] 47 C.F.R. § 27.1412(d)(1)(i).

[9] *See* 47 C.F.R. § 25.147 ("The 3.7-4.0 GHz portion of the band is being transitioned in CONUS from FSS GSO (space-to-Earth) to the 3.7 GHz Service."); *see also C-Band R&O* ¶ 175.

by the accelerated relocation deadlines.[10] SES operates several such satellites under Commission authority to provide service to the United States using the 3.7-4.2 GHz band.[11] A full list of these satellites is provided in Appendix A.

To identify the satellites that must be transitioned to meet the accelerated relocation deadlines, SES leveraged its internal fleet management resources to determine the most efficient way to migrate customers on SES's satellite fleet to clear spectrum while ensuring continuity of service.

Among the elements considered were:

- Satellite capabilities, performance, and available capacity;
- Orbital location field of view, operational restrictions, and satellite penetration into CONUS earth stations;
- Protection schemes available on the satellites and across the fleet;
- Contractual obligations and future commercial needs;
- Channel line-up and programming requirements; and
- Specific mobility[12] and government customer constraints and requirements.

It is important to note that orbital locations are not fungible, and certain orbital locations are better suited for certain services compared to others. Only satellites located within the U.S. orbital arc are suitable for the delivery of broadcast and cable services on which nearly 120 million American households rely. Yet even within the U.S. orbital arc, not all orbital locations are suitable for all applications. For example, the distribution of cable video services requires strict 50-state coverage, effectively narrowing the orbital locations (specifically, between 135° W.L. and 99° W.L.) within which satellites used for cable distribution can be placed to maintain "look" angles able to see New England, Maine, and Alaska. It is critically important to maintain sufficient antenna elevation angles after the transition process is complete because of the

[10] *See C-Band R&O* ¶ 204 (permitting as reimbursable transition costs non-CONUS "system modifications . . . as a direct result of the transition in [CONUS] to make spectrum available for flexible use").

[11] These satellites are authorized through a U.S. license or through a grant of U.S. market access.

[12] Specifically, SES considered maritime services where ship-to-shore and shore-to-ship traffic was required to be assessed to develop the most efficient and effective transition approach.

aggressive power flux density limit adopted in the *C-Band R&O*, which assumes an earth station antenna elevation angle of at least 19 degrees.[13]

SES has developed a robust broadcast and cable video distribution neighborhood using its orbital locations at 101° W.L., 103° W.L., and 105° W.L. These orbital locations offer 50-state coverage, and earth station antennas receiving content carried on satellites operating at these orbital locations are already pointed to this four-degree slice of the geosynchronous orbital arc.

Orbital locations outside the U.S. arc are not suitable for distribution of broadcast or cable video services because of the low look angles and lack of 50-state coverage. Customers providing this video programming thus cannot simply be moved to a C-band satellite outside the U.S. orbital arc to clear spectrum for 5G terrestrial operations. Moreover, SES uses its non-U.S. orbital locations for distribution of broadcast programming in other regions and for data applications such as maritime and aeronautical mobile satellite services. For example, SES satellites in orbital locations 20° W.L. to 47.5° W.L., are unable to provide service to the western portion of the United States but can offer coverage between the east coast of the United States and Europe. Similarly, NSS-9 at 177° W.L. is unable to provide service to the eastern portion of the United States but offers connectivity between the U.S. west coast and Asia.

As a result, clearing the lower 300 MHz in CONUS will indirectly impact the loading of satellites that mainly serve areas outside CONUS but that also need to land services in CONUS, for either further distribution to consumers or monitoring of services intended for non-U.S. consumers.

B. New Satellites to be Launched (§ 27.1412(d)(1)(ii))

In addition to the transitions that need to occur on existing satellites as described above, SES will need to invest more than $1.25 billion to manufacture and launch new satellites to ensure continuity and quality of existing service to nearly 120 million U.S. households in the accelerated relocation timeframe established in the *C-Band R&O*.[14] These new satellites are necessary to guarantee that sufficient on-orbit capacity exists to provide substantially the same or better service for current customers after the transition is complete.[15]

Prior to the FCC's Notice of Inquiry[16] SES was finalizing the consolidation of cable programming to the satellites operating at 101° W.L., 103° W.L., and 105° W.L. On that basis,

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[13] *See C-Band R&O* ¶ 363, n.799.

[14] *Id.* ¶ 194. Appendix D details SES's estimated transition costs.

[15] *See C-Band R&O* ¶ 153 ("We find our approach here . . . provid[es] incumbent space station operators the flexibility to launch additional satellites to achieve an efficient transition to the upper portion of the band.").

[16] *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN Docket No. 17-183, Notice of Inquiry, 32 FCC Rcd 6373 (2017).

SES had made the business decision not to place new C-band satellites at 135° W.L. and 131° W.L., and instead to use those orbital locations for non-cable video distribution services, such as mobility services via inclined-orbit satellites. SES had determined it could serve existing and future business requirements with the 500 MHz of downlink bandwidth available at the center of the arc, 101° W.L., 103° W.L. and 105° W.L. (3 x 500 MHz = 1500 MHz), including protection transponders (described below). Further, without a compelling customer use case (for example long term commitments by major customers), when it became time to replace the satellite at 103° W.L. (SES-3), SES's nominal fleet plan has long been to migrate its cable video distribution customers primarily to the satellites at 101° W.L. and 105° W.L.

Because the *C-Band R&O* requires in-CONUS C-band distribution to be consolidated into 200 MHz of downlink bandwidth, SES will need a total of six satellites to support its existing C-band cable video distribution customers. SES will need five active satellites to ensure at least 1000 MHz of downlink bandwidth is available to continue existing services (i.e., 5 x 200 MHz = 1000 MHz). This means that new C-band satellites will need to be constructed, launched, and located in the orbital slots not only at 103° W.L. but also at 131° W.L. and 135° W.L. as well. SES must replace the C-band satellites at these locations to maintain its service continuity commitments to existing customers.[17] SES will also need another satellite to provide required capacity for protection from transponder or satellite failures.[18]

SES has customers on its existing satellites who have contractual "protection" rights, which obligate SES to maintain transponders (generally on separate satellites from where the customers are located, in case of a satellite failure) that are always available to restore service within a matter of days if those customers experience transponder failures or service disruptions.[19] At

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[17] Eutelsat has suggested that SES does not need to launch a new satellite to 135° W.L. because it recently relocated AMC-8 to the orbital location. Comments of Eutelsat S.A. on the Transition Plans filed by SES Americom, Inc. and Intelsat License LLC, GN Docket Nos. 18-122 & 20-173, at 5 (filed July 13, 2020). As noted in the modification application requesting authority to relocate AMC-8, it has experienced solar array circuit failures and battery cell failures that have affected the total power available to the spacecraft, and is now configured only for inclined operation. SES Americom, Inc., (Call Sign S2379) File No. SAT-MOD-20200413-00033 (granted July 1, 2020). As a result, AMC-8 has sufficient capability to support SES's current commercial needs, but it does not have the on-board capabilities necessary for station-kept operations required to support the distribution of video services from 135° W.L. pre- and post-transition.

[18] *See C-Band R&O* at n.102 (acknowledging SES's grooming plan included "SES also operating an in-orbit spare").

[19] *See* Letter from Matthew S. DelNero, Counsel for Discovery, Inc., Fox Corp., The Walt Disney Company, and Univision Communications, Inc., to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 18-122 & 20-173 (filed July 31, 2020); Letter from Brian D. Weimer, Counsel for SES, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 18-122 & 20-173 (filed July 29, 2020).

present those commitments are met using transponders on SES's existing satellites.[20] But with only 200 MHz of on-board downlink bandwidth per satellite, after careful analysis SES has determined that the only realistic way to maintain its service restoration obligations is to use a dedicated "in-orbit spare." SES plans to meet this obligation by co-locating a second C-band satellite at 103º W.L. to satisfy contractual restoration obligations for customers at 105º W.L., 103º W.L., and 101º W.L. and therefore providing substantially same-or-better[21] service after the transition as they had before.

The in-orbit spare will not be actively broadcasting while it is co-located with an operational satellite at 103° W.L. It will only begin broadcasting in the event one of the satellites in the center of the arc experience a service outage that impacts a customer who has purchased full service protection. The transponders on the in-orbit spare are part of SES's existing service to its customers who have been and continue to pay significant amounts for SES to have that additional restoration capacity available if needed.[22] Without an in-orbit spare, if one of the satellites operating in the U.S. arc fails, it may take months or years to recover the service, forcing SES to breach its contractual obligations to existing customers and significantly disrupting the customers' existing services. Without the in-orbit spare, SES will not be able to provide substantially the same or better service for current customers post-transition.

Consequently, SES's transition requires the manufacture and launch of four C-band spacecraft comprising: (i) a replacement at 135º W.L.; (ii) a replacement at 131º W.L.; (iii) a replacement at 103º W.L.; and (iv) one in-orbit spare satellite (to be collocated at 103º W.L.) to meet existing contractual obligations to customers for in-orbit protection. These satellites will offer C-band-only (*i.e.*, no Ku-, Ka- or other frequency payloads) service over the 50 United States at similar or improved power levels.[23] The satellites have been designed to ensure substantially the same or better service to current customers and Incumbent Earth Station operators.[24] While these

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[20] Prior to the *C-Band R&O*, 500 MHz of downlink bandwidth at each of the satellites in the three center arc orbital locations provided SES with sufficient spare capacity to satisfy its service restoration obligations.

[21] *See infra* note 22.

[22] *See C-Band R&O* ¶ 194 ("'Reasonable' relocation costs are those *necessitated by the relocation* in order to ensure that incumbent space station operators continue to be able to provide substantially the same or better service . . . . So long as the costs for which incumbents are seeking reimbursement are *reasonably necessary* to complete the transition in a timely manner (and reasonable in cost), such expenses would be compensable.") (emphasis added).

[23] All of the new satellites will provide an EIRP performance over CONUS which is better than what is currently provided by SES-3 and AMC-11 (the satellites being replaced), with a minimum EIRP of 41 dBW over CONUS (and many areas reaching an EIRP of 42-43 dBW).

[24] Certain commenters requested that link budgets of replacement satellites be included in transition plans. *See* Comments of ACA Connects, GN Docket No. 20-173, at 22 (filed July 13,

satellites will include incidental coverage of areas around the United States (similar to current SES satellites at 101 º W.L, 103 º W.L and 105 º W.L), such as Mexico, SES does not intend to provide international-only services over these satellites.

The four C-band spacecraft are planned to be launched by the end of Q3 2022, after which the relevant services will be transitioned as described in more detail below. See Table 1 below.

135ºW	**131ºW**	**105ºW**	**103ºW**		**101ºW**
[AMC-10R]	[AMC-11R]	SES-11	[SES-3R]	New Spare Satellite	SES-1

Table 1: Future Fleet Deployment

SES's nominal launch plan is to launch the first two satellites to 131° W.L. (AMC-11R) and the in-orbit spare position at 103° W.L. The second two satellites will operate at 135° W.L. (AMC-10R) and 103°W.L. (SES-3R). While the satellites have been designated as SES-18, SES-19, SES-20, and SES-21 with the manufacturers, the location of each of these named satellites will depend upon the order in which they are launched. SES will launch the first satellites that are available to meet its nominal replacement schedule. To assist stakeholders (namely, SES customers and other Incumbent Earth Stations) in identifying transition satellites,[25] SES uses the placeholder naming convention shown in brackets in Table 1.

The need to meet very aggressive transition deadlines poses significant risks for SES. The new satellites will require between two and three years to manufacture and at least two additional months for launch (including shipment and a launch campaign), assuming all launches go as scheduled and that the manufacturer finishes on time so the pre-reserved launch slots can be utilized. Following launch, up to eight weeks are needed for the satellites to reach their orbital destination, be fully tested in orbit, and commence commercial service.

To have C-band spectrum cleared in the lower 300 MHz by the beginning of December 2023 and

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2020) ("ACA Connects Comments"). For its part, SES's replacement satellites are designed to deliver service using operating parameters (including power levels) that are the same or better than the satellites that will be replaced. Link budgets—which are highly specific to a particular earth station operator—can therefore not be provided on a generic basis without being misleading.

[25] Including an "R" on a satellite designation indicates that the satellite is a replacement for an existing satellite that will be retired from an orbital location. Since the AMC-10 satellite formerly was located at 135° W.L. (it has since been re-orbited), we use AMC-10R to indicate the new satellite that will be located at 135° W.L. Each of these locations will subsequently be the location for one of the satellites SES-18, SES-19, SES-20, or SES-21.

to allow sufficient time for the migration of services, SES is targeting launches by Q3 of 2022 and will have reserved launch slots in the manifests of SES's launch service providers. SES is working closely with its satellite manufacturers and launch service providers to meet the deadlines and reduce the time lost between satellite construction completion, launch campaign, and start of services. SES is also working with the manufacturers to determine the number of new antennas needed at SES TT&C facilities for operation of each new satellite to meet this target.

SES therefore needs also to order and construct spare satellites and launches as backup for the satellites to be deployed. If the primary satellites are lost due to launch failures or the inability to place the satellite in the proper orbit, it would be much too late to start construction of new satellites and still meet the tight timelines required for spectrum clearing by early December 2023. It is a common and commercially reasonable practice in the satellite industry to construct ground spares, to be launched only in the event of a satellite failure (at least when alternate contingency plans are not available, which is the case here given the need to add so many new satellites so quickly to meet aggressive transition deadlines). Given the truncated timing, there would not be another two to three years of flexibility if there is a launch failure.

To provide assurance to customers that it can maintain service continuity, in June 2020 SES contracted for the procurement of two ground spare satellites. The manufacturing of the first ground spare satellite started immediately in order to be ready for launch within a few weeks after any potential launch failure of one of the first two dual launches (described below). The manufacturing of the second ground spare will start in a few months, consistent with the SES contingency fleet plan. Subject to the successful launch and deployment of the first four satellites included in the final Transition Plan, SES will then determine whether or not to finalize the second ground spare program and will seek reimbursement only for the costs incurred until that moment for the second ground spare program, including termination liability.

SES also determined that using dual launches for its new satellites is the most failsafe and commercially reasonable approach under these circumstances. SES and Intelsat are constructing new C-band satellites at about the same time, and are planning to launch all these satellites in a matter of a few months, since both operators are working towards the same deadline. Because more than ten replacement C-band satellites will need to be launched for SES and Intelsat, essentially concentrating a large number of launches during the same launch period, and since the new C-band satellites are in addition to the planned launches of other satellites already in the manifests of launch providers, launch capacity in the relevant time frame is quite limited. SES determined that a dual-launch deployment strategy is necessary to ensure it could meet the Commission's clearing deadlines and a single launch strategy would not be logistically feasible.[26] Additionally, multiple single launches would expose SES to additional launch failure

[26] In the course of SES's analysis and discussions with satellite manufacturers and launch service providers, it was determined that use of single launches and one fewer ground spare was not logistically feasible on the Commission's accelerated clearing timeline.

risk and increase the likelihood of launch delay due to launch vehicle unavailability. Given that SES needs *all* of its replacement satellites to be launched successfully and on time to meet the Phase II deadline, a dual-launch strategy significantly reduces the execution risk.

Procuring six satellites (four nominal and two spare satellites) is the optimal and necessary strategy for SES to ensure service continuity for existing customers and to ensure the C-band spectrum is cleared consistent with the FCC's accelerated relocation deadlines.

For the same reasons as the purchase of the two ground spare satellites, SES is purchasing additional launches for the ground spare satellites to address the risk of launch failure. Launch vehicles of the type needed for launch of the ground spare satellites are expected to require close to two years to complete, so the contingency launches need to be purchased well in advance to ensure the deadline is met in case of a launch failure.

In the event of any launch failures, SES will submit a claim to the insurers. In the event that the claim results in a reimbursement to SES from the insurers, and to the extent that the claim covers amounts that have been reimbursed by the Relocation Payment Clearinghouse, SES will in turn refund the appropriate amount to the Relocation Payment Clearinghouse.

C. Plan to Migrate Existing Services (§ 27.1412(d)(1)(iii))

SES is committed to relocating all services that are contracted as of the date of each accelerated clearing deadline in advance of the deadline.[27] To accomplish this, SES has worked to develop an efficient transition process for all affected services to minimize as much as possible the impact to SES customers and their affiliated earth stations. Based on the current SES plan, there are 178 services in total that are impacted by the C-band repurposing: 112 services on domestic satellites (SES-1, SES-2, SES-3, SES-11, AMC-11, AMC-3) and 66 services on international satellites (SES-4, SES-6, SES-14, NSS-9, NSS-10). SES will be required to perform 100 frequency/satellite moves for services, gateway moves for 61 services, 11 services will require compression/modulation upgrades (and also frequency/satellite moves), and 6 mobile services may require frequency moves on the same satellite should the user determine it is necessary.

To maintain continuous service and service quality, when a service is migrated from one satellite to one in another orbital location, SES will provide customers with a period of dual illumination during which customers will commence the new service on a phased basis before giving up access to the prior service. These dual-illumination periods will allow for Incumbent Earth Stations to have sufficient time to repoint or install new antennas, as well as make other necessary adjustments (such as installing feeds and LNBs). Dual-illumination minimizes service interruption arising from the transition.

Appendix B provides (1) a detailed list of the services that will be migrated by each of the Phase I and Phase II deadlines, (2) the satellites and frequencies they will be moved to, and (3) the start

[27] 47 C.F.R. § 27.1411(b)(4) (defining "Earth station migration").

and end of the transition period for each service.[28] As previously stated, the new satellites are designated with an "R" at the end of the satellite name to reflect replacement satellites. Customers whose service will be supported at 103° W.L. or 131° W.L. will ultimately be receiving service from a new satellite (with an "R" designation) even if they initially receive service on an existing satellite at those orbital locations.

Since the services shown in Appendix B are for actual SES customers, to protect the confidentiality of SES's customers each service is identified by a "Service ID."[29] Each customer has been informed of its Service ID, and therefore can easily confirm that the transition described in Appendix B reflects the plan SES has communicated to it. Services currently above 4.0 GHz and not requiring any type of transition are not included in Appendix B.

The details of each service transition, such as the service's ultimate satellite and frequency as well as the timing of the transition, is subject to change, particularly due to actions taken by SES's customers. For example, an SES customer may choose not to renew services, may ask to complete its transition early, or may mutually agree with SES to modify the transition satellite to which its service is to be relocated, or the frequency, timing or other factors affecting its service or the transition process. For any potential changes after August 14, 2020, SES will notify the Commission in its quarterly status reports[30] and update its Transition Plan as needed.[31]

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[28] ACA Connects requested that SES and Intelsat include additional migration data that is outside the scope of the *C-Band R&O* and the Commission's rules. *Compare* ACA Connects Comments at 22-23 (requesting a table that includes "bit rate, video compression, modulation, and video resolution" for each video feed), *with C-Band R&O* ¶ 303 (requiring transition plans include a grooming plan for existing services, "including the pre- and post-transition frequencies that each customer will occupy"). *See also* 47 C.F.R. § 27.1412(d)(1)(iii).

[29] One commenter requested that SES identify its customers by name. Comments of Verizon, GN Docket Nos. 18-122 & 20-173, at 2-3 (filed July 13, 2020) ("Verizon Comments"). But due to SES's confidentiality obligations to its customers, SES cannot disclose the names of its customers in this appendix. *See also C-Band R&O* at n.684 ("We clarify that nothing in this *Report and Order* is intended to affect or change the terms of any private contractual arrangement."). And given that Service IDs already provide SES's customers with the information needed to ensure that their services are being migrated appropriately, SES has not identified a need to specify confidential customer information. But to the extent the Commission determines that such information is "necessary to effectuate the transition," SES requests that the Commission affirmatively state as much. *See id.* at n.694.

[30] *C-Band R&O* ¶ 316; 47 C.F.R. § 27.1412(f).

[31] *C-Band R&O* ¶ 306.

D. Technology Upgrades to be Implemented (§27.1412(d)(1)(iv))

The *C-Band R&O* notes that "upgrades such as video compression, modulation/coding, and HD to SD down-conversion at downlink locations, may be necessary to accomplish efficient clearing."[32] To ensure that it can deliver substantially same-or-better services with only 40 percent of the spectrum being usable for continuing C-band communications, SES has explored ways to reduce the capacity needs of existing services through technology upgrades.

SES determined that one customer currently receiving services from 11 transponders on one SES satellite will require compression/modulation technology upgrades for the service to continue to be provided at the same quality level after the relocation.[33] Specifically, the pre-transition services encoded using MPEG-2 will be upgraded to MPEG-4, which will support substantially same or better service in much less bandwidth. With technology upgrades, the customer's post-transition needs are reduced to only 5-6 transponders,[34] which will allow those services to continue to be downlinked on a single satellite which is necessary for this particular service. Changes will be needed at the customer's uplink locations as well as at the receiving Incumbent Earth Station locations. At the customer uplink locations, encoding, statistical multiplexing, modulator and other equipment will be required. At the Incumbent Earth Station downlink locations, integrated satellite receiver/decoders ("IRDs"), multiplexing, and other equipment may be required.

This use of compression technology is necessary in light of the very limited orbital slots available to SES to maintain its C-band service obligations with only 40 percent of the available capacity. This approach works well from a technological (and economic) perspective because of the large number of transponders used by this customer; the same approach would not be as effective for customers using a small number of transponders.

For services below 4.0 GHz on SES's international satellites that cannot be transitioned above 4.0 GHz due to unavailable capacity on those international satellites, SES will be performing other types of technology upgrades for customers that require transition of data services that operate on an SES-supplied platform or a platform at a customer's facility. SES will build a

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[32] *Id.* ¶ 194.

[33] *Id.* ("Earth station migration includes . . . technology upgrades necessary to facilitate the repack, such as compression technology or modulation."); Letter from Brian D. Weimer, Counsel for SES, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 5 (filed July 8, 2020) ("the space station operators' control over video quality is inherently limited to a defined network distribution architecture that involves transmit and receive antennas located on the spacecraft and in rare cases—most of which are not video networks—at antennas located at earth stations.").

[34] SES's customer is currently evaluating the final number of transponders that will be required after the implementation of the technology upgrades. Once this number is finalized, SES will provide an update in its quarterly reports to the Commission.

duplicate platform, including hub chassis, line cards, modems, core network components, and other equipment at one of the TT&C/Gateway sites where downlinking services below 4.0 GHz will be permitted. Once built, the data service will be transitioned from the existing platform to the new platform. The original platform will be decommissioned after the service is fully transitioned. Because the transition of platform services requires more equipment and time, the full transition may not be completed before the Phase I clearing deadline.

Appendix B also sets forth information on when a particular service requires a technology upgrade as part of its transition.

E. Number and Location of Incumbent Earth Stations to be Transitioned (§27.1412(d)(1)(v)-(vi))

Appendix C identifies Incumbent Earth Station[35] sites that are affected by the service transitions identified in Appendix B. Specifically, the data provided in Appendix C lists each earth station location that SES believes to the best of its knowledge[36] hosts an Incumbent Earth Station receiving at least one service from an SES satellite.[37] This list has been prepared using as its basis the final list of Incumbent Earth Stations published by the International Bureau on August 3, 2020.[38] When an Incumbent Earth Station operator elects to take a lump sum payment according to the Commission's process[39] rather than participate in SES's Transition Plan, SES will remove from its Transition Plan the Incumbent Earth Stations covered by the lump sum election. If at any time SES determines that an Incumbent Earth Station on the list in Appendix C is not receiving services from an SES satellite, the list will be updated accordingly and included in SES's quarterly reports.

Section 27.1412(d)(1)(vi) requires satellite operators to provide "an estimate of the number and location of Incumbent Earth Station antennas that will require retuning and/or repointing in order

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[35] For the avoidance of doubt, an Incumbent Earth Station is defined as a single antenna that appears within a filing in the FCC's List of Incumbent Earth Stations.

[36] SES's analysts have compared the List of Incumbent Earth Stations released by the International Bureau on August 3, 2020, to the affiliate earth station lists provided by SES customers to clarify the Incumbent Earth Station locations assigned to SES satellites. This revised list is included in Appendix C. Earth station locations that are not on the August 3, 2020, list are not included in Appendix C.

[37] *See* Section 25.138 of the Commission's rules, 47 C.F.R. § 25.138.

[38] *International Bureau Releases List of Incumbent Earth Stations in the 3.7-4.2 GHz Band in the Contiguous United States*, Public Notice, IB Docket No. 20-205, DA 20-823 (rel. Aug. 3, 2020).

[39] *Wireless Telecommunications Bureau Releases Final Cost Category Schedule for 3.7-4.2 GHz Band Relocation Expenses and Announces Process And Deadline For Lump Sum Elections*, Public Notice, IB Docket No. 20-205, DA 20-802 (rel. July 20, 2020).

to receive content on new transponder frequencies post-transition."[40] In many cases a single antenna may be receiving a number of different services from the same satellite. In order to implement a change in frequency on the same satellite, the receiver connected to the antenna and associated with the transitioning service will need to be retuned and, if a polarization change is required, a feed/LNB assembly may need to be installed on the antenna if it does not currently exist.

SES will endeavor to repoint antennas, but this is not possible for all earth stations. For example, if a service will be transferred to another satellite, in most circumstances a new antenna will be needed rather than repointing the existing antenna as the existing antenna will continue to receive other services, either from the original satellite or other satellites operated by SES or other satellite operators. Also, repointing an antenna could create a significant service outage that may not be acceptable to an Incumbent Earth Station operator and can be avoided by installing a new antenna. Fortunately, based on the customer outreach SES has performed, SES understands that, in the vast majority of cases,[41] an antenna is already available at the Incumbent Earth Station site to receive service from the new satellite.

To generate the data on which Appendix C is based, SES received feedback from and conducted considerable outreach to owners or operators of Incumbent Earth Stations, used internal databases, the FCC's IBFS database, the FCC's list of Incumbent Earth Stations (released August 3, 2020), and feedback from customers to develop its current understanding of the universe of Incumbent Earth Stations receiving transmissions from SES satellites that will be impacted by the satellite service transitions, as shown in Appendix C. In some cases where accurate data was not available, SES made a "worst-case" estimate and assumed the highest number of services that may be transitioning at the Incumbent Earth Station.[42] In other cases, where complete data was not available regarding Incumbent Earth Station sites to verify that they are accessing SES satellites, but where SES has good reason to believe they are,[43] SES has included these in Appendix C. Furthermore, multiple filings at the same earth station site that SES has determined are or may be accessing SES satellites are also included in Appendix C.[44]

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[40] 47 C.F.R. § 27.1412(d)(1)(vi).

[41] In SES's current estimate, approximately 90% of Incumbent Earth Stations already have an antenna pointed towards the SES satellite(s) to which services currently received by those satellites will be transitioned.

[42] For example, if a customer is utilizing two transponders and SES is not able to determine which services on the two transponders are being received by an Incumbent Earth Station, SES assumed both transponders are being received and the data in Appendix C includes both services.

[43] For example, SES assumes all MVPD Incumbent Earth Station sites receive some services from SES satellites as SES satellites carry unique programming that is likely distributed by every MVPD in CONUS.

[44] SES identifies earth stations by location, not filing, call sign or site ID.

SES will continue to research Incumbent Earth Stations to make sure all of SES's associated Incumbent Earth Stations are addressed.

SES developed its initial list of the Incumbent Earth Station sites from customers' affiliate lists, research, and from the FCC's IBFS database. The owner/operator of each of the Incumbent Earth Stations included on the initial list has been or will be contacted by an outreach vendor initially to confirm general earth station information, such as contact details, site location information, and number of antennas accessing SES satellites at the site. A separate installation vendor will then coordinate with each Incumbent Earth Station operator to determine the equipment required for the transition (antenna equipment, filters, etc.) depending on the needs of the site in accordance with the service transitions described in Appendix B and the status of the Incumbent Earth Station on the FCC's Incumbent Earth Station List. The installation vendor will confirm the number of Incumbent Earth Stations at the site accessing SES satellites, which will define the number of passband filters that must be installed. The installation vendor will determine if an additional or replacement antenna is needed for the Incumbent Earth Station to continue accessing SES's services, which may be migrated to a different SES satellite. For example, a site may only have one antenna available, but two antennas may be needed to continue downlinking the equivalent SES services post-transition. For those sites that are receiving services from the single SES customer that requires a compression/modulation technology upgrade, SES is currently gathering additional information through directed outreach which is expected to be completed in September 2020. This extensive outreach and individualized communications and coordination with Incumbent Earth Station operators will augment SES's current internal Incumbent Earth Station databases and will be utilized to ensure that every individual Incumbent Earth Station accessing SES satellites will have their specific needs addressed, including Incumbent Earth Station operators' requests for specific equipment for a particular site prior to and during the equipment installation process.

For Incumbent Earth Stations requiring equipment (other than filters), prior to the service transition periods defined in Appendix B, SES-hired installation teams will contact Incumbent Earth Station operators to schedule a time during which they will install equipment. For example, SES anticipates that all MVPD Incumbent Earth Stations will be scheduled for equipment and filter installations within the last six months of the Phase I and Phase II clearing timelines because most MVPD Incumbent Earth Stations will require access to several satellites and all transitions on those satellites will need to be completed before any filters are installed.[45] On the other hand, some Incumbent Earth Stations, such as those that only need access to one service on one satellite, may be able to accommodate the installation of filters at any time. SES's internal communications team, through the assistance of a third-party outreach vendor, and its third-party installers working with SES customers and industry groups will provide

[45] SES and Intelsat have already provided the multi-stakeholder technical working group (which includes Verizon) with the technical specifications of the filters that will be installed at Incumbent Earth Station sites. *See* Verizon Comments at 3 (requesting "a description of filter characteristics").

Incumbent Earth Station operators with a notification as to the overall timeframe when filter installation is expected to occur. SES anticipates that (as required by the *C-Band R&O*) each Incumbent Earth Station operator will cooperate with SES to grant installers access to their facilities and equipment within the defined timeframe to ensure a smooth transition process.

SES recognizes that some Incumbent Earth Station may have unique characteristics or requirements, including old and obsolete facilities, and will require a customized approach to timely transition every associated Incumbent Earth Station. When the installer visits the site, the installation technician will be equipped to address a number of potential scenarios, including cases where an antenna is not performing adequately when tested prior to any work that needs to be done, the inability to install a filter due to antenna mechanical issues, and antennas in hard-to-reach locations.

The *C-Band R&O* holds incumbent satellite operators individually responsible for migrating customer services out of the lower 300 MHz. At cable headends, incumbent earth station operators are likely to have antennas that access multiple satellite operators, which could create logistical challenges if migration is not managed efficiently.

Given the added complexity at these earth stations, Intelsat and SES have agreed to coordinate some of the commonly required activities. Both operators will take individual responsibility for their antenna seeding plans, for their customer compression upgrades, and for any other customer specific work required at an earth station. After the customer migrations are completed, Intelsat and SES have agreed to coordinate filter installation for incumbent earth stations located at cable headends and any other incumbent earth station sites that have antennas accessing both Intelsat and SES satellites. Such coordination will minimize the burden on the earth station technical staff and will reduce the risk of issues occurring during the filter installation process.

SES and Intelsat have also agreed to voluntarily install filters on any unregistered antennas located at Incumbent Earth Station sites at the same time they install filters on the collocated Incumbent Earth Stations that receive services from either SES or Intelsat satellites. The fact that SES and Intelsat will install filters on these unregistered antennas does not change their status with respect to the *C-Band R&O* and therefore, these unregistered antennas will not be eligible for interference protection from future licensed terrestrial services.[46] Furthermore, because SES and Intelsat are volunteering to take on this filtering activity, which is outside the scope of the obligations imposed by the *C-Band R&O*, the unregistered antennas subject to this agreement will not be considered part of SES or Intelsat's accelerated clearing obligations or relevant for either operator's accelerated clearing certification. Finally, for the avoidance of doubt, SES and Intelsat will not install filters or take any responsibility for transitioning unregistered antennas that are not collocated with an Incumbent Earth Station pointed to an Intelsat or SES satellite.

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[46] *C-Band R&O* ¶ 123.

SES anticipates that certain Incumbent Earth Station operators will prefer to install equipment needed for the transition on their own.[47] For such self-installations, SES requests the Incumbent Earth Station operator to notify SES in email format to Cbandhelp@ses.com no later than October 14, 2020 of its intent to self-install equipment. The notice must specify if the Incumbent Earth Station operator plans to (1) procure equipment on its own, and therefore will be seeking reimbursement directly through the Relocation Payment Clearinghouse rather than looking to SES to cover the cost of the equipment, or (2) request SES-provided equipment and provide SES with a list of the equipment that is required for each Incumbent Earth Station.[48] SES expects most Incumbent Earth Station operators to request SES-provided equipment, but this is a choice each Incumbent Earth Station operator can make. The notice must also provide a detailed listing of the equipment needed for each physical Incumbent Earth Station identified in the FCC's Incumbent Earth Station List receiving service from an SES satellite. SES will review these details to determine the eligibility for reimbursement of the equipment prior to ordering and shipping to the Incumbent Earth Station operator's location.

For Incumbent Earth Station operators choosing to self-install equipment, SES will provide the timeline within which the dual illumination of all affected services will occur and when the equipment must be installed. Upon receipt of the necessary equipment by the Incumbent Earth Station operator, SES will then provide the Incumbent Earth Station operator remote assistance via SES's help desk as needed to support the installation. The Incumbent Earth Station operator must provide SES with a certification confirming that all of the equipment has been installed and tested on all Incumbent Earth Stations receiving SES services at that location, and no operational issues have been identified. Following receipt of such certification, SES will deem all Incumbent Earth Stations receiving service from an SES satellite at that location as cleared for purposes of this Transition Plan.

SES is not responsible for the quality of equipment purchased by the Incumbent Earth Station operator or the workmanship of the self-installation. If an Incumbent Earth Station operator informs SES it intends to self-install but fails to provide a certification in a timely manner, SES should not be obligated to provide a certification of completion for that Incumbent Earth Station operator. In its quarterly status report to the Commission, SES will provide a list of all Incumbent Earth Stations that have notified SES of their intent to self-install SES-provided equipment or their directly purchased equipment, including whether a certificate of completion has been received denoting the transition of the particular Incumbent Earth Station is complete.

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[47] These self-install Incumbent Earth Station operators are not the ones electing to receive a lump sum payment – SES will have no obligations with regard to the operators electing the lump sum payment beyond providing necessary equipment where a technology upgrade is required and responding to the elected earth station operator's request to coordinate with SES, as necessary. SES will provide support to self-install Incumbent Earth Station operators, as discussed herein.

[48] SES will provide equipment only for Incumbent Earth Stations receiving service from an SES satellite.

As part of SES's election to clear on an accelerated basis, SES has committed "to take responsibility for relocating its associated [I]ncumbent [E]arth [S]tations by" the accelerated relocation deadlines.[49] Associated Incumbent Earth Station operators accordingly must "facilitate [SES's] completion of [] earth station[] relocation," including "by helping with scheduling, providing access to facilities, and confirming the work performed."[50]

If SES learns of any potential earth station transition delays, as contemplated by the *C-Band R&O*, SES intends to work expeditiously with the Incumbent Earth Station operator, Relocation Coordinator, and the Bureau to resolve such issues consistent with SES's Transition Plan, including its transition timeline. SES also intends to timely inform the Bureau of any "earth station transition delays" that are beyond SES's control.[51]

F. Gateway and TT&C Transition

The *C-Band R&O* requires SES to identify two of the four protected TT&C locations in its transition plan.[52] For the avoidance of doubt, SES is selecting the Hawley and Brewster sites as its two protected TT&C locations.

SES will supplement its TT&C services to support the new and existing satellites in compliance with the FCC clearing requirements. To that end, SES will be enhancing the capabilities at Hawley and Brewster to support the testing and operations of SES's North America fleet utilizing C-band. To accomplish these requirements, SES will install full-motion antennas and associated satellite ground control equipment at each location. Once the new full-motion antennas are installed and tested, SES will no longer receive TT&C signals below 4.0 GHz at any CONUS location other than Hawley and Brewster, which are permitted by the *C-Band R&O* to receive TT&C signals below 4.0 GHz on a protected basis. SES will continue to use its existing teleports to receive signals in the 4.0-4.2 GHz band.

SES will also relocate downlink services associated with international video feeds, data and other services that cannot be transitioned out of the 3.7-4.0 GHz band to the Hawley and Brewster sites.[53] These services cannot be transitioned into the upper 200 MHz of C-band spectrum for one of several reasons. One overarching issue is the lack of available capacity in the upper 200

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[49] *C-Band R&O* ¶ 292.

[50] *Id*.

[51] *Id.* ¶ 294.

[52] *Id.* ¶ 374 ("Should the incumbent space station operators fail to come to consensus, we expect that SES would identify two locations and Intelsat would identify the other two locations.").

[53] *Id.* at n.826 ("[The Commission] expect[s] that all incumbent space station operators will have the opportunity to co-locate their TT&C and international gateways at [consolidated TT&C/Gateway sites].").

MHz once all of the CONUS services are transitioned.[54] Also, it may not be possible to transition the uplink frequency due to other local regulatory factors such as coordination with terrestrial fixed services in the 6 GHz band (when the service has an uplink paired with the downlink below 4.0 GHz) or technical restrictions in the uplink equipment itself.

Consistent with the *C-Band R&O,* SES intends to receive signals in the 3.7-4.0 MHz band on an unprotected basis at the TT&C Gateway sites.[55] The transition of such signals will follow one of two approaches. International video feeds and some of the data service downlinks will be transitioned simply by installing antennas and IRDs or other equipment at the TT&C/Gateway sites to receive the signals in the current frequency from the current satellite. The received signals will then be delivered to current customer downlink locations via terrestrial means. Other data services that operate through a VSAT-type managed platform will be migrated in whole (*i.e.*, the platform itself will be relocated to the Hawley or Brewster sites) and the two-way data service will be interconnected via terrestrial means with existing customer hub locations.

II. Reporting and Certification of Clearance

Beginning December 31, 2020, SES will submit a quarterly status report summarizing the status of its clearing efforts. SES intends to include in each report a list of the Incumbent Earth Stations receiving services from SES that have been fully transitioned pursuant to this Transition Plan.

The quarterly status report will also identify any Incumbent Earth Stations that have elected to self-install the necessary equipment, and whether a certificate of completion has been received denoting the transition of the particular Incumbent Earth Station is complete. Any Incumbent Earth Station operator who believes its Incumbent Earth Station has been incorrectly identified as transitioned should contact SES within 30 days after the report is posted to the FCC's Electronic Comment Filing System ("ECFS").

On or before each of the accelerated clearing deadlines, SES will file a certification confirming that the relevant Incumbent Earth Stations, previously reflected in its quarterly status reports and those cleared after the most recent report have been transitioned.

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[54] *See* Letter from Bill Tolpegin, Chief Executive Officer, C-Band Alliance, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 8 (filed Jan. 14, 2020) ("[Consolidated TT&C/Gateway] sites are critical . . . because they serve as gateways (or ingest points) for a significant amount of customer services that must maintain access to the entire 500 MHz of the FSS C-band downlink band.").

[55] *C-Band R&O* ¶ 380.

III. Timeline (§ 27.1412(d)(1)(vii))

The full scope of the service transitions described above and in Appendix B are reflected in the timeline provided in Appendix E. The timeline is a high-level description of all of the many complex and time-consuming activities SES will complete to meet the accelerated relocation deadlines and reflects the extensive discussions SES held with customers and other C-band stakeholders. Customers and associated Incumbent Earth Station operators should refer to the transition times associated with their specific services in Appendix B to understand when they and their affiliates will be subject to dual illumination and any equipment changes.

A more detailed description of each element of the timeline is provided below. In some cases, SES has identified the nominal timeline for a particular activity (blue) and an additional "contingency" timeline (yellow) to reflect that some activities may take longer than anticipated but can still be completed by the Phase I or Phase II clearing deadlines.

Transitions: During the time periods designated for "Transition" in the Appendix E timeline, SES will perform all necessary activities to migrate services on its satellites and install all necessary equipment resulting from the satellite service migrations at affected Incumbent Earth Stations and install requisite passband filters. In some cases, services that are affected by the Phase II deadline may be transitioned during the Phase I period to improve efficiencies and reduce the impact on Incumbent Earth Station operators.

Technology Upgrades: As described in Section I.D, SES will work with its one customer receiving a compression/modulation technology upgrade to install encoding, statistical multiplexing, modulators and other equipment at the customer's uplink sites while simultaneously installing IRDs, multiplexing and other equipment at the associated Incumbent Earth Stations. For other technology upgrades described in Section I.D (other than platform migrations), SES will work with affected customers to assess the most efficient method for effectuating upgrades, including identifying specific equipment requirements such as demodulators, networking equipment and terrestrial service requirements to allow customer downlinks to be migrated to Hawley or Brewster and delivered via terrestrial means to current customer downlink locations. The compression/modulation technology upgrade is expected to take place in both Phase I and Phase II as the services requiring technology upgrades occupy both Phase I and Phase II frequencies. Generally, downlink-only upgrades will be performed in the phase in which the corresponding transponder service migrations occur.

Platform Migrations: Platform migrations as described in Section I.D are complex and time-consuming, and as such will be performed over an extended period. As an individual platform may carry services that require transition over both Phase I and Phase II, necessary upgrades such as line cards will be installed in stages such that prioritization is given to services that must be migrated in Phase I.

Filter Installations: SES will begin shipping and installing filters as early as August 2020 on Incumbent Earth Stations that do not require any service transitions. For all other associated Incumbent Earth Stations, once all of the services received by the antenna are transitioned to their final frequencies, polarizations, or satellites, SES or the Incumbent Earth Station operator can install a passband filter. SES anticipates it will commence filter installation for Phase I

services from August 1, 2020, through November 30, 2021. Filter installation for Phase II services will occur from August 1, 2020, through November 30, 2023.

Gateway Migrations: The gateway migrations consist of installing downlink equipment at the Hawley and Brewster sites to access all satellites shown in Appendix A. The gateway and teleport equipment and facilities for Phase I customer transitions will be in place no later than December 5, 2021, and for Phase II customer transitions no later than December 5, 2023. SES will endeavor to have these facilities available in advance of these milestone dates, in line with the planned transition dates outlined in Appendix B. Because the transition of platform services requires more equipment and time, the full transition may not be completed before the Phase I clearing deadline.

Satellite Procurement: SES has entered into manufacturing contracts to build a total of four satellites and two ground spares necessary to effectuate the transition according to the Commission's aggressive timetable. The initial four satellites are scheduled to be launched by the end of Q3 2022. SES has also entered into launch service agreements to support the launch of the four satellites. As discussed above, SES must undertake dual launches. However, some additional launch reservations will be purchased for contingency to address potential manufacturing delays or launch failures.

Service Migrations: SES anticipates it will take two to four months after the satellites are launched to raise the satellites to their testing orbit locations, complete testing, move the satellites to their final orbital locations, and initiate service on the satellites.

IV. Estimated Costs

Appendix D provides the estimated costs associated with the Transition Plan described herein.

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Appendix A

Authorized Space Stations Subject to Transition

The table below details the SES satellites on the list of space stations licensed under Part 25 of the Commission's regulations or granted access to the U.S. market pursuant to Section 25.137 of the Commission's rules that can carry services impacted by the transition.

Space Station	Call Sign	Orbital Location (Deg. W.L.)	Station-kept (SK) / Inclined (I)	Services impacted?
NSS-7	S2463	20	I	
SES-4	S2828	22	SK	Y
NSS-10	S2415	37.45	I	Y
SES-6	S2870	40.5	SK	Y
SES-14	S2974	47.5	SK	Y
AMC-3	S2162	72	I	Y
AMC-6	S2347	139[56]	SK	
SES-2	S2826	87	SK	Y
SES-1	S2807	101	SK	Y
SES-3	S2892	103	SK	Y
SES-11	S2964	104.95	SK	Y
AMC-11	S2433	131	SK	Y
AMC-4	S2135	135	SK	
AMC-8	S2379	135	I	
AMC-18	S2713	139/83	SK	
NSS-9	S2756	177	SK	Y

[56] AMC-6 is scheduled to arrive at 139° W.L. on or around August 23, 2020, pursuant to its modified license. *See* SES Americom, Inc., (Call Sign S2347) File No. SAT-STA-20200605-00067 (granted June 19, 2020).

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Appendix B

Plan to Migrate Existing Services

This appendix provides a description of the accompanying MS Excel file ("Appendix B Excel File") that details the services that will be impacted by the SES Transition Plan. The format of the Appendix B Excel File is as shown below, along with a description of each field. Services not requiring relocation above 4.0 GHz are not included in the Appendix B Excel File. As discussed above, SES has continued to refine its plan through discussions with customers and additional internal review since the initial plan was filed on June 19, 2020. As a result, a number of changes have been made to the Appendix B Excel File in the preliminary Transition Plan. A number of entries have changed as a result of customer contract changes, planning optimization as well as corrections for typographical errors. A number of entries have been added, while others that were determined to be outside of CONUS or already received in the Brewster or Hawley sites were removed.

Appendix B Excel File		
Field Number	Field Name	Field Description
1	Service ID	An SES generated string for identifying each unique service impacted by the SES Transition Plan. It is a concatenation of the satellite, transponder, center frequency, and bandwidth of the service in the record
2	Pre-Transition Satellite	The current satellite the service resides on
3	Pre-Transition Transponder	The current transponder the service resides on
4	Pre-Transition Center Frequency	The current center frequency of the service in MHz
5	Pre-Transition Bandwidth	The current bandwidth of the services in MHz
6	Post-Transition Satellite	The satellite the service will be transitioned to; in many cases the Transition Satellite is the same as the Current Satellite which indicates the service will not be transitioning to another satellite
7	Post-Transition Transponder	The transponder the service will be transitioned to
8	Post-Transition Center Frequency	The center frequency of the service after transition in MHz
9	Post-Transition Bandwidth	The bandwidth of the service after transition in MHz
10	Transition Start	The start date of the dual illumination window or transition of the service in yyyy-mm-dd format
11	Transition End	The end date of the dual illumination

		window or transition of the service in yyyy-mm-dd format
12	Technology Upgrade / Type	An "N" in Field 12 indicates no technology upgrade needed for this service. A "C/M" in Field 12 indicates that the service will undergo a technology upgrade of compression and modulation. A "G" in Field 12 indicates the service will be transitioned to Hawley or Brewster.

A small number of services in the Appendix B Excel File will be experiencing two transitions on an SES satellite. For these services, there will be one record indicating the first transition and another indicating the second transition where Field 1 through Field 5 indicates the service details after the first transition.

For the services in the Appendix B Excel file with the service IDs of

AMC-3_03C_3760_36 ("Service 1")

AMC-3_04C_3780_36 ("Service 2")

AMC-3_05C_3800_36 ("Service 3")

AMC-3_06C_3820_36 ("Service 4")

AMC-3_10C_3900_36 ("Service 5")

AMC-3_15C_4000_36 ("Service 6")

SES has informed the customer that these services, if currently being received in CONUS, will need to be (1) used for shore-to-ship only, (2) transitioned to a frequency above 3820 MHz prior to 5 December 2021 for those services below 3820 MHz and to a frequency above 4000 MHz prior to 5 December 2023 for those services below 4000 MHz, or (3) terminated altogether prior to 5 December 2021 for those services below 3820 MHz and terminated altogether prior to 5 December 2023 for those services below 4000 MHz. SES has provided the customer with sufficient capacity above 3820 MHz to transition Service 1 through Service 4. Although SES does not have sufficient capacity on AMC-3 to support all of the existing services below 4000 MHz, it is understood that the service is a mix of ship-to-shore and shore-to-ship services and as such not all of the AMC-3 capacity is downlinked by a CONUS-based fixed earth station. Notwithstanding, SES has also informed the customer that if sufficient capacity is not available above 4000 MHz on AMC-3 to support all ship-to-shore traffic downlinked to a CONUS-based fixed earth station, SES can downlink such services at Hawley or Brewster and deliver the service terrestrially to customer's existing downlink location.

SES offers service through its SES Government Solutions subsidiary to Raytheon Technologies, which operates an FAA / WAAS system at the SES South Mountain TT&C/Gateway location in Somis, CA. The service includes operations in the lower portion of the C-band, which will require a transition from C-band to Ka-band to allow for continued satellite tracking post-transition. SES is currently in discussions with Raytheon to assess various options for the continuation of the operation of the system and envisions that certain equipment and professional services will be required to transition the Raytheon system. After the final option is selected, SES will procure and arrange for the installation of the necessary equipment.

Finally, the Transition Plan does not reflect transitions specifically focused on the occasional use ("OU") market, because SES does not provide guaranteed long-term OU capacity and no such specific transitions are necessary. As SES has previously stated, prior to the planned transition, SES has been able to serve the needs of OU operators by making available transponders that are idle for a short period of time in the scope of full-time customer migrations.[57] The market for OU services is relatively small and on a downward turn in light of market forces and increased reliance on fiber-based services. As such, SES's ability to continue to provide OU services will not be impacted by its transition of other services. The availability of short-term idle transponders will not be impacted by the transition and SES will continue to make transponders that are temporarily available for OU use after the transition is complete just as it did before the transition.[58] In other words, the transition will have no impact on the extent or availability of idle transponders for OU service.

[57] *See* Letter from Brian D. Weimer, Counsel for SES, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed June 17, 2020).

[58] *Id*.

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Appendix C

Incumbent Earth Stations to be Transitioned

This appendix provides a description of the accompanying MS Excel file ("Appendix C Excel File") that details the Incumbent Earth Station locations that currently receive services[59] from SES satellites. The data in the Appendix C Excel file is based on SES's best understanding at the time this Transition Plan is submitted of the earth station sites that host an antenna on the FCC List of Incumbent Earth Stations released on August 3, 2020, that qualify as Incumbent Earth Station sites. As part of this research, SES analysts categorized each earth station by type (e.g., cable operator, TV broadcaster) and compared it to affiliate lists received from a number of SES customers. As a result, SES was able to determine which Incumbent Earth Station sites it believes are accessing SES satellites through the means described in Section I.E[60] (see tab C-1 in the Appendix C Excel File) or believes could be accessing SES satellites (see tab C-2 in the Appendix C Excel File) which will be confirmed after the filing of the SES Transition Plan either directly by SES or through the Relocation Coordinator. All filings associated with the Incumbent Earth Station sites in tabs C-1 and C-2 are listed in tab C-3 in the Appendix C Excel file. Note that C-3 is provided as additional information only and not all of the antennas associated with the filings listed in C-3 access SES satellites and therefore are not SES' responsibility. Further outreach to Incumbent Earth Station sites will be necessary to associate IBFS filings with Incumbent Earth Stations at each location. Also, SES has not included any Incumbent Earth Stations that SES has a strong reason to believe are not accessing SES satellites. The format of the Appendix C Excel File is as shown below, along with descriptions of each field.

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[59] A service is defined as a contracted continuous bandwidth segment on an SES satellite as set forth in Appendix B. If sufficient details were not provided by the SES customer, it is assumed that an Incumbent Earth Station receives all services provided by a particular SES customer. In all likelihood, this is not the case and as such the number of transitions that an Incumbent Earth Station will experience will be less than shown. In the notification period for each transition, the actual number of transitions per Incumbent Earth Station will be determined.

[60] 47 C.F.R. § 27.1411(b)(4) (defining "Earth station migration").

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Table C-1: Contents of Appendix C Excel File Tab C-1

Field Number	Field Name	Field Description
1	Name of Applicant	The applicant name as it appears in the IBFS
2	Site Address	The street address of the Incumbent Earth Station as it appears in the IBFS
3	Site City	The city of the Incumbent Earth Station as it appears in the IBFS
4	Site State	The state of the Incumbent Earth Station as it appears in the IBFS
5	Site Zip Code	The zip code of the Incumbent Earth Station as it appears in the IBFS
6	Number of Antennas Accessing SES Satellites	The total number of antennas and/or feeds[61] in the case of multi-feed antennas estimated to be used for receiving services from SES satellites at the Incumbent Earth Station location
7	Service Transition	A "N" in this field indicates that this Incumbent Earth Station only receives services from SES satellites that will not require a transition (e.g., the services are above 4.0 GHz); in this case the Incumbent Earth Station will only require passband filters. A "Y" in this field indicates the Incumbent Earth Station is currently receiving services from an SES satellite that will undergo a transition in frequency or satellite
8	# Services Transitioning on Same Satellite	The number of services currently received at this Incumbent Earth Station that will be changing frequency on the same satellite
9	# Services Transitioning to New Satellite	The number of services currently received at this Incumbent Earth Station that will be migrated to a different satellite
10	# Services Transitioned to an SES Gateway	The number of services currently received at the Incumbent Earth Station that will be transitioned at Hawley or Brewster and delivered via terrestrial means to the current Earth Station Location
11	Note	Notes associated with record data

[61] It is difficult to determine at this time if an Incumbent Earth Station is using a single feed or multiple feed antenna to access a particular SES satellite. Therefore, the number of antennas shown in Field 5 may overstate the number of antennas SES has estimated at an Incumbent Earth Station that are accessing SES satellites.

Table C-2: Contents of Appendix C Excel File Tab C-2

Field Number	Field Name	Field Description
1	Name of Applicant	The applicant name as it appears in the IBFS
2	Site Address	The street address of the Incumbent Earth Station as it appears in the IBFS
3	Site City	The city of the Incumbent Earth Station as it appears in the IBFS
4	Site State	The state of the Incumbent Earth Station as it appears in the IBFS
5	Site Zip Code	The zip code of the Incumbent Earth Station as it appears in the IBFS

Table C-3: Contents of Appendix C Excel File Tab C-3

Field Number	Field Name	Field Description
1	Name of Applicant	The applicant name as it appears in the IBFS
2	File Number	The application file number as it appears in the IBFS
3	Call Sign	The Incumbent Earth Station call sign as it appears in the IBFS
4	Site ID	The site ID of the Incumbent Earth Station as it appears in the IBFS
5	Site Address	The street address of the Incumbent Earth Station as it appears in the IBFS
6	Site City	The city of the Incumbent Earth Station as it appears in the IBFS
7	Site State	The state of the Incumbent Earth Station as it appears in the IBFS
8	Site Zip Code	The zip code of the Incumbent Earth Station as it appears in the IBFS

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Appendix D

Estimated Costs

Category	**Total**
Satellite replacement program (total estimated cost)	$1,329,000,000
• Satellites (6 satellites)	$869,000,000
• Launches (2 dual launches + 2 single launches)[62]	$340,000,000
• Satellite ground control and TT&C systems, program management and insurance	$120,000,000
Filters and LNBs[63]	$101,000,000
Antennas[64]	$23,000,000
Dual Illumination	$7,000,000
Other Services[65]	$10,000,000
Technology Upgrades	$133,000,000
TT&C / Gateway Consolidation	$56,000,000
Other[66]	$16,000,000
Total	**$1,675,000,000**

[62] SES's transition plan assumes two dual-launches and two single-launches for launch risk mitigation.

[63] Includes installation.

[64] Ibid.

[65] Includes outreach, data collection, data analysis, stakeholder communications, technical consulting, and installation help desk.

[66] Includes legal, communications, Relocation Coordinator, Clearinghouse, etc.

These estimated costs reflect specific costs that are determined from contracts SES has already entered into as well as estimated costs for hardware and services that have not yet been purchased.

The satellite procurement estimates relate to the information provided in Section I.B above. The costs for four satellites plus two ground spares are based on manufacturing contracts. Similarly, the launch costs reflect the contracted cost for two dual-launches and a single contingency launch if the first of the two ground spares must be launched. A second single launch may be needed in the event the second ground spare must be launched, and the estimated cost of that launch is included. In the event of launch failures, the incremental insurance costs are not reflected above, and reimbursement will only be sought if such costs are incurred.

The costs identified for filters and LNBs, antennas, dual illumination, and other services reflect the activities described in Sections I.C and I.E above. SES has entered into agreements with a number of the suppliers and has utilized the referenced estimates from the equipment and services RFPs in forming the projected cost structure. The technology upgrade costs reflect the activities described in Section I.D and the TT&C and gateway upgrade costs relate to the activities described in Section I.F.

The internal manpower and financing charges associated with the specific categories described above has been incorporated into the specific related category.

Appendix E

Transition Timeline

The following represent SES's overall transition timeline. Required individual customer transition schedules are referenced in Appendix B, and are subject to adjustment as required by SES.