Supplementary Material

Table S1.

Mass Breakdown of Items Supplied to the International Space Station from Oct. 2017 to Feb 2020

Category	Subcategory (Leach and Ewert, 2021)	Percentage within the Supplied Mass (Leach and Ewert, 2021) [%]	Estimated Mass [kg]	Estimated Mass [kg/Crew Member per day]	Remarks
Environmental Control and Life Support Systems (ECLSS)	[Air] Filtering	0.68	416.81	0.090	-
	[Air] Monitoring & Control	4.42	2709.29	0.583	Air revitalization and atmospheric monitoring, the thermal control system, etc.
	[Air] Kits	2.38	1458.85	0.314	NORS (Nitrous/Oxygen Recharge System) maintenance kits, etc.
	[Air] Pipes & Pumping	0.34	208.41	0.045	(Not specified but categories as air pipes and pumps in this study)
	[Air] Gas Recharge	2.04	1250.44	0.269	-
	[Water] Water System	8.50	5210.17	1.121	Water containers and all other water-based consumables, etc.
	[Water] Waste Containment	1.36	833.63	0.179	-
	[Water] Toilet	1.36	833.63	0.179	-
	[Other] Life Support System	11.56	7085.83	1.525	Russian supplied items but details are unknown. Not counted in this study.
	[Other] Other	1.36	833.63	0.179	-
Food	Packaged Food	16.38	10040.31	2.161	-
	Food Kits	0.42	257.44	0.055	Nutritional supplement kits, small food kits, and chewing gum kits
	Food Systems	4.20	2574.44	0.554	Food supply system which is a Russian food source
Clothing	Shirts	0.90	551.67	0.119	-
	Undergarments	0.51	312.61	0.067	-
	Socks	0.24	147.11	0.032	-
	Gloves	0.03	18.39	0.004	-
	Footwear	0.12	73.56	0.016	-
	Harness/ Tethers	0.15	91.94	0.020	-
	Belts	0.03	18.39	0.004	-
	Shorts	0.24	147.11	0.032	-
	Pants	0.18	110.33	0.024	-
	Generalized	0.15	91.94	0.020	-
	Specialized /Other	0.45	275.83	0.059	-
Hygiene	Towels/Wipes	3.60	2206.66	0.475	-
	Solutions/Creams	0.24	147.11	0.032	-
	Deodorant	0.00	0.00	0.000	-
	Dental	0.06	36.78	0.008	-
	Shaving	0.00	0.00	0.000	-

	Cargo	0.36	220.67	0.047	-
	Other Items	1.74	1066.55	0.230	-
Operational Supplies	Total	4.00	2451.85	0.528	Bags, office supplies, Laptops, etc.
Health	Fitness	0.50	306.48	0.066	-
	Medical Kits	0.34	208.41	0.045	-
	Small Items	0.02	12.26	0.003	-
	Exposure	0.03	18.39	0.004	-
	Cardio	0.02	12.26	0.003	-
	Monitoring	0.09	55.17	0.012	-
Personal	Total	-	0.00	0.000	Headphones, Music, and other personal items.
Science and Outfitting	Total	29.00	17775.88	3.825	Items related to scientific experiments and outfitting such as test setups and lab supplies.
EVA	Total	2.00	1225.92	0.264	Replacement space suit parts such as gloves, liquid cooling vests, etc.
TOTAL [a]			61296.14	-	

[a] Total mass was estimated by combining the data that the rate of food usage during October 2017 through February 2020 was 2.77 kg/CM-d (Leach and Ewert, 2021), the food mass was 21% of the overall launch mass (Leach and Ewert, 2021), the number of days during the period was 882 days, and the average number of crew members during the period was approximately 5.269 persons derived from each crew members' ISS arrival and departure date (NASA, 2024).

Table S2.

List of Resupply Missions and Mass Breakdown of the Launch Mass from Oct. 2017 to Feb 2020

			Rocket				Spacecraft		Resupplies	
No.	Mission Name	Launch date	Rocket Type	Rocket Mass (Dry) [kg]	Rocket Mass (Propellant) [kg]	First Stage Engine (Recycled) [kg]	Spacecraft Type	Dry mass [kg]	Life Support and Well-being Items [kg]	Water (90% Recycled) [kg]
1	Progress 68P	2017/10/14	Soyuz-2.1a	33,032	272,140	-	Progress-MS	4879	1849	420
2	OA-8	2017/11/12	Antares 230 (2nd Stage: Castor 30 XL)	22,700	266,200	-	Enhanced Cygnus	3,400	1240	-
3	CRS-13	2017/12/15	Falcon 9 Core 1035	26,200	518,400	-	CRS Dragon	4200	490	-
4	Progress 69P	2018/2/13	Soyuz-2.1a	33,032	272,140	-	Progress-MS	4936	1866	430
5	CRS-14	2018/4/2	Falcon 9 Full Thrust	26,200	518,400	22,200	CRS Dragon	4200	344	-
6	OA-9E	2018/5/21	Antares 230 (2nd Stage: Castor 30 XL)	26,200	518,400	-	Enhanced Cygnus	3,400	811	-
7	CRS-15	2018/6/29	Falcon 9 Full Thrust	26,200	518,400	22,200	CRS Dragon	4200	205	-
8	Progress 70P	2018/7/9	Soyuz-2.1a	33,032	272,140	-	Progress-MS	4831	1745	420
9	HTV-7	2018/9/22	H-II B	69,600	458,400	-	H-II Transfer Vehicle	10,500	470	420
10	Progress 71P	2018/11/16	Soyuz FG	24,160	274,240	-	Progress-MS	4862	1845	440

11	OA-10E	2018/11/17	Antares 230 (2nd Stage: Castor 30 XL)	26,200	518,400	-	Enhanced Cygnus	3,400	1141	-
12	CRS-16	2018/12/5	Falcon 9 Block 5 (Mass unknown, used Falcon 9 Data)	26,200	518,400	-	CRS Dragon	4200	304	-
13	Progress 72P	2019/4/4	Soyuz-2.1a	33,032	272,140	-	Progress-MS	4831	1847	400
14	OA-11	2019/4/17	Antares 230 (2nd Stage: Castor 30 XL)	26,200	518,400	-	Enhanced Cygnus	3,400	987	-
15	CRS-17	2019/5/4	Falcon 9	26,200	518,400	22,200	CRS Dragon	4200	338	-
16	CRS-18	2019/7/25	Falcon 9	26,200	518,400	22,200	CRS Dragon	4200	233	-
17	Progress 73P	2019/7/31	Soyuz-2.1a	33,032	272,140	-	Progress-MS	3958	1635	420
18	HTV-8	2019/9/24	H-II B	69,600	458,400	-	H-II Transfer Vehicle	10,500	0	-
19	OA-12	2019/11/2	Antares 230 (2nd Stage: Castor 30 XL)	26,200	518,400	-	Enhanced Cygnus	3,400	680	-
20	CRS-19	2019/12/5	Falcon 9	26,200	518,400	22,200	CRS Dragon	4200	256	-
21	Progress 74P	2019/12/6	Soyuz-2.1a	33,032	272,140	-	Progress-MS	3958	1832	420
22	OA-13	2020/2/15	Antares 230 (2nd Stage: Castor 30 XL)	26,200	518,400	-	Enhanced Cygnus	3,400	712	-
-	-	-	TOTAL MASS (Recycled Mass)	698,652	9,310,880	111,000 (111,000)	-	103,055	20,830	3,370 (3,033)