

CubeSats as the first (and second) satellite of your country



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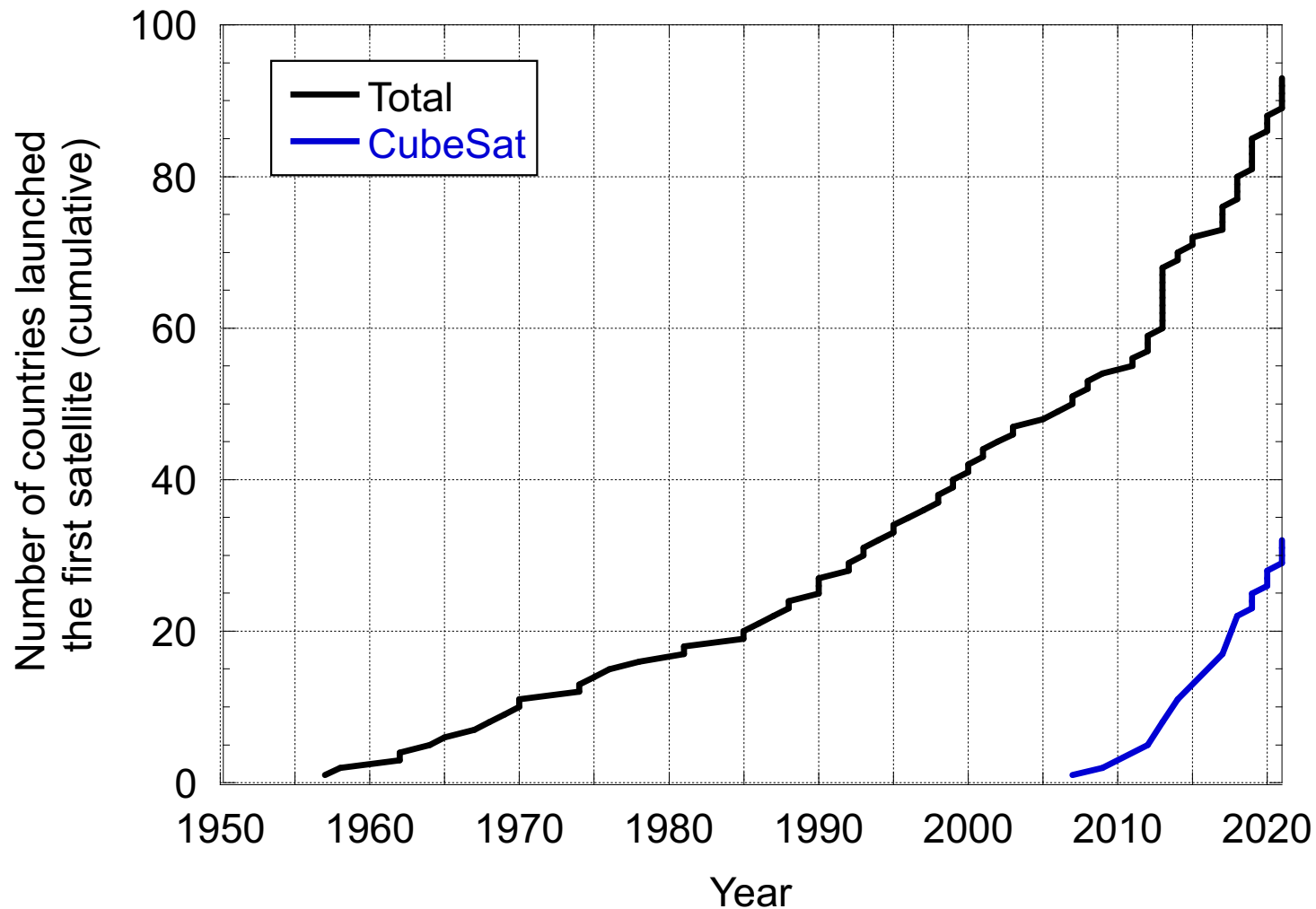
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How many countries own satellites?



- Nowadays, more than 80 countries own (owned) satellites
- There are about 200 countries/regions in the world



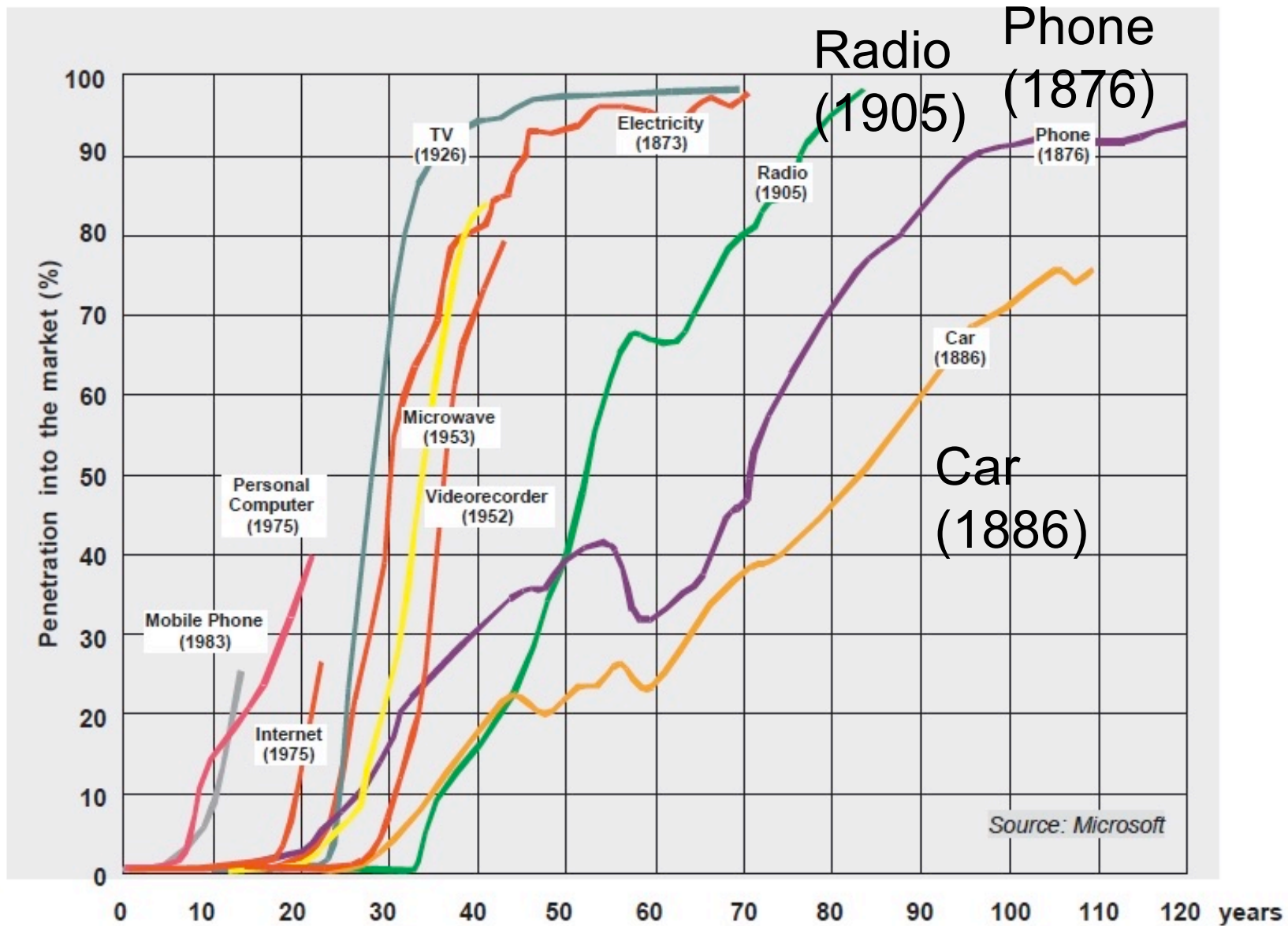


Figure 2-4 In the last century, the time from prototype to significant market penetration is dramatically reduced¹¹

(From INCOSE Handbook)

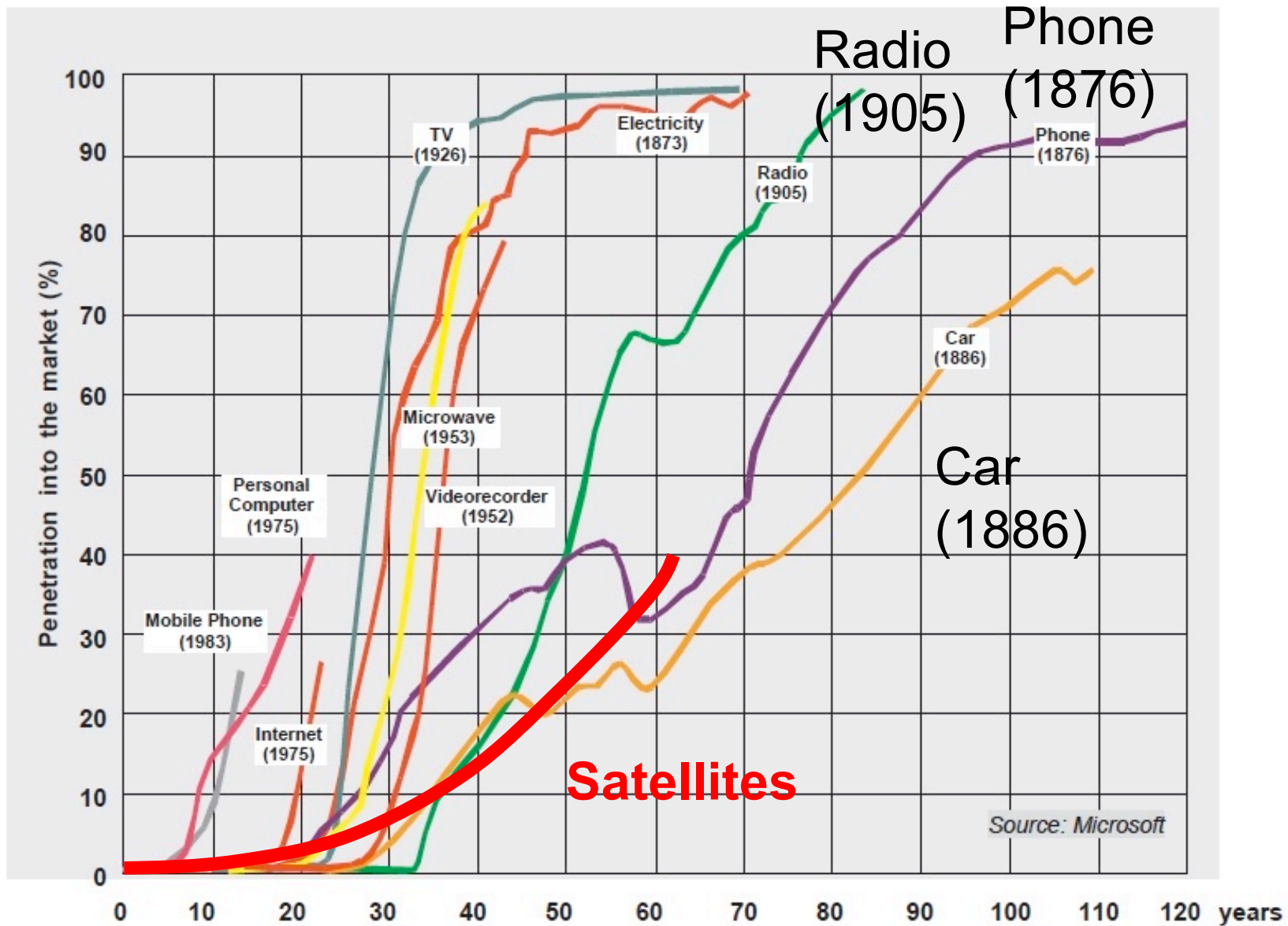


Figure 2-4 In the last century, the time from prototype to significant market penetration is dramatically reduced¹¹

(FROM INCOSE HANDBOOK)

Countries launched a CubeSat as the first satellite



| No. | Country | Satellite name | Launch Year |
|-----|-------------|---------------------------|-------------|
| 1 | Columbia | Libertad 1 | 2007 |
| 2 | Switzerland | SwissCube | 2009 |
| 3 | Hungary | Masat-1 | 2012 |
| 4 | Romania | Goliat | 2012 |
| 5 | Poland | Pwsat 1 | 2012 |
| 6 | Ecuador | NEE-01 Pegaso | 2013 |
| 7 | Estonia | EstCube 1 | 2013 |
| 8 | Peru | PUCPSat-1 | 2013 |
| 9 | Lithuania | LitSat 1 , LitaunicaSat 1 | 2014 |
| 10 | Uruguay | Antelsat | 2014 |
| 11 | Iraq | Tigrisat | 2014 |
| 12 | Finland | Aalto 2 | 2017 |
| 13 | Bangladesh | BRAC Onnesha | 2017 |
| 14 | Ghana | Ghanasat-1 | 2017 |
| 15 | Mongolia | Mazaalai | 2017 |
| 16 | Slovakia | SKCUBE | 2017 |
| 17 | Latvia | Venta-1 | 2017 |
| 18 | Kenya | 1KUNS-PF | 2018 |
| 19 | Costa Rica | Irazu | 2018 |
| 20 | Bulgaria | EnduroSat One | 2018 |
| 21 | Bhutan | BHUTAN-1 | 2018 |
| 22 | Jordan | JYAT (JO-97) | 2018 |
| 23 | Sri Lanka | Raavana 1 | 2019 |
| 24 | Nepal | NepaliSat-1 | 2019 |
| 25 | Rwanda | RWASAT-1 | 2019 |
| 26 | Guatemala | Queztzal-1 | 2020 |
| 27 | Slovenia | TRISAT | 2020 |
| 28 | Monaco | OSM-1 CICERO | 2020 |
| 29 | Paraguay | GuaraniSat-1 | 2021 |
| 30 | Kuwait | QMR-KWT | 2021 |
| 31 | Bahrain | Light-1 | 2021 |
| 32 | Armenia | ARMSAT 1 | 2022 |
| 33 | Moldova | TUMnanoSAT | 2022 |
| 34 | Uganda | PealAfricaSat-1 | 2022 |
| 35 | Zimbabwe | ZIMSAT-1 | 2022 |

CubeSat contributed to democratize space.
But is it enough?

Countries launched a CubeSat as the first satellite

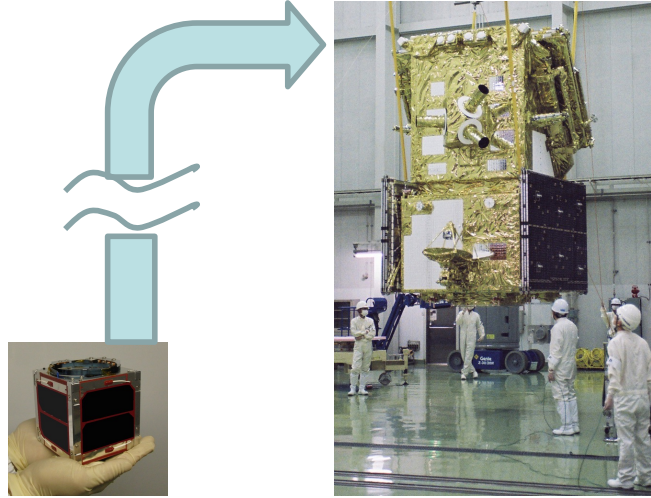


| No. | Country | Satellite name | Launch Year | Second Satellite | Total (Dec.31, 2022) |
|-----|-------------|---------------------------|-------------|------------------|----------------------|
| 1 | Columbia | Libertad 1 | 2007 | 2018 | 2 |
| 2 | Switzerland | SwissCube | 2009 | 2010 | 20 |
| 3 | Hungary | Masat-1 | 2012 | 2019 | 5 |
| 4 | Romania | Goliat | 2012 | N/A | 1 |
| 5 | Poland | Pwsat 1 | 2012 | 2013 | 14 |
| 6 | Ecuador | NEE-01 Pegaso | 2013 | 2013 | 4 |
| 7 | Estonia | EstCube 1 | 2013 | 2019 | 3 |
| 8 | Peru | PUCPSat-1 | 2013 | 2014 | 4 |
| 9 | Lithuania | LitSat 1 , LitaunicaSat 1 | 2014 | 2017 | 6 |
| 10 | Uruguay | Antelsat | 2014 | N/A | 1 |
| 11 | Iraq | Tigrisat | 2014 | N/A | 1 |
| 12 | Finland | Aalto 2 | 2017 | 2017 | 25 |
| 13 | Bangladesh | BRAC Onnesha | 2017 | N/A | 1 |
| 14 | Ghana | Ghanasat-1 | 2017 | N/A | 1 |
| 15 | Mongolia | Mazaalai | 2017 | N/A | 1 |
| 16 | Slovakia | SKCUBE | 2017 | 2021 | 2 |
| 17 | Latvia | Venta-1 | 2017 | N/A | 1 |
| 18 | Kenya | 1KUNS-PF | 2018 | 2021 | 2 |
| 19 | Costa Rica | Irazu | 2018 | N/A | 1 |
| 20 | Bulgaria | EnduroSat One | 2018 | 2021 | 3 |
| 21 | Bhutan | BHUTAN-1 | 2018 | N/A | 1 |
| 22 | Jordan | JYAT (JO-97) | 2018 | N/A | 1 |
| 23 | Sri Lanka | Raavana 1 | 2019 | N/A | 1 |
| 24 | Nepal | NepaliSat-1 | 2019 | N/A | 1 |
| 25 | Rwanda | RWASAT-1 | 2019 | N/A | 1 |
| 26 | Guatemala | Queztzal-1 | 2020 | N/A | 1 |
| 27 | Slovenia | TRISAT | 2020 | 2020 | 3 |
| 28 | Monaco | OSM-1 CICERO | 2020 | N/A | 1 |
| 29 | Paraguay | GuaraniSat-1 | 2021 | N/A | 1 |
| 30 | Kuwait | QMR-KWT | 2021 | N/A | 1 |
| 31 | Bahrain | Light-1 | 2021 | N/A | 1 |
| 32 | Armenia | ARMSAT_1 | 2022 | N/A | 1 |
| 33 | Moldova | TUMnanoSAT | 2022 | N/A | 1 |
| 34 | Uganda | PealAfricaSat-1 | 2022 | N/A | 1 |
| 35 | Zimbabwe | ZIMSAT-1 | 2022 | N/A | 1 |

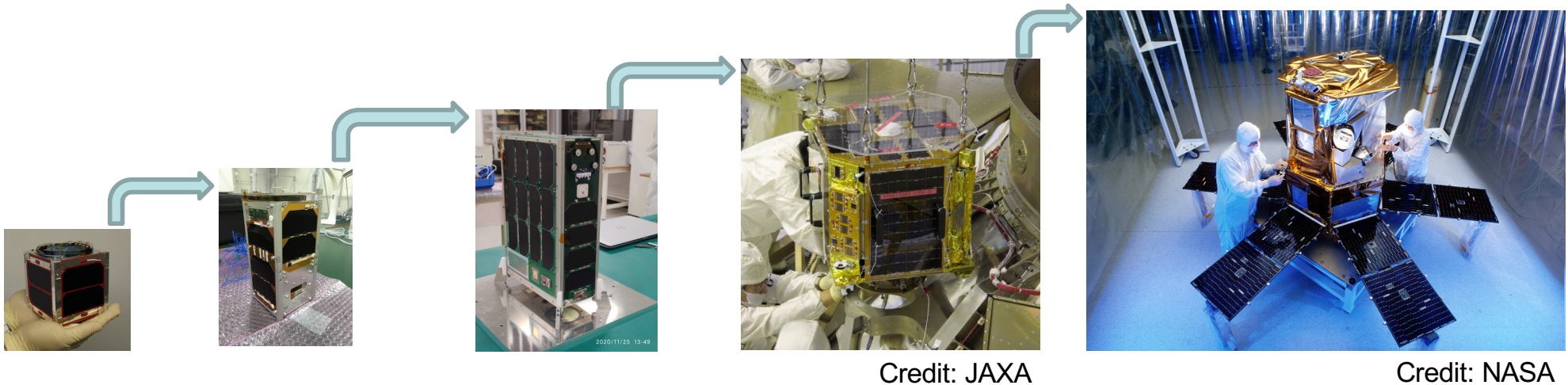
Many countries still struggling to launch the second ones

Sustainability

It is not a good idea to attempt a giant leap



Instead, proceed step-by-step -- and continuously



Let's think about how to make the first step and move one step up