# Project Status Report

## High End Computing Capability
## Strategic Capabilities Assets Program

December 10, 2017

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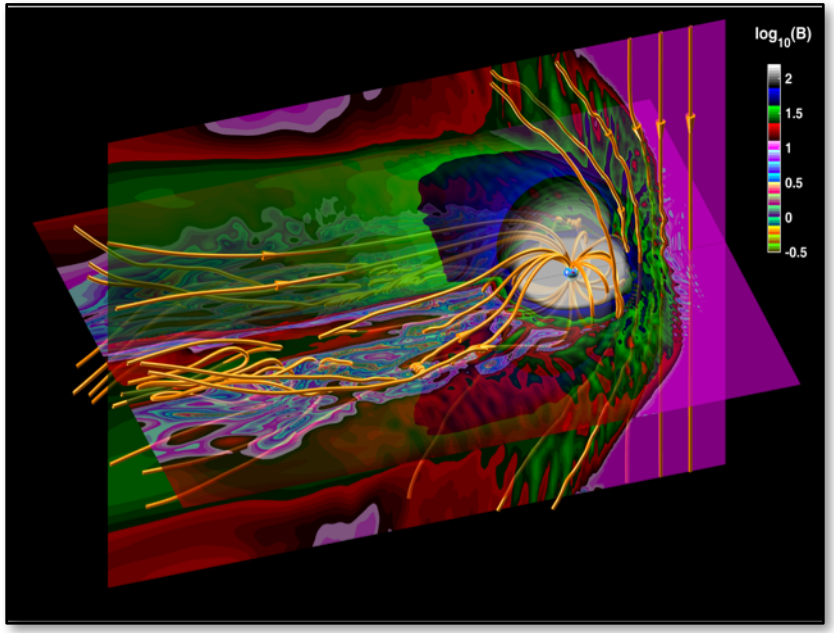
# APP Team Helps Auburn Scientist Investigate Heliophysics Grand Challenge

- The Applications Performance and Productivity (APP) team improved the science results and performance of the Auburn Global Hybrid Code in 3D (ANGIE3D) space simulation code.
- ANGIE3D is used to simulate the region of space around the Earth where the solar wind interacts with Earth's magnetic field. This magnetosphere is the origin of geomagnetic storms, which are connected to the aurora borealis and may produce disturbances that affect satellites and electric grids on Earth.
- The APP team modified the code to allow it to get correct results when the simulation is scaled to larger processor counts.
- Through a series of 21 modifications, including extensive restructuring of memory layout, vectorization, code simplification, and compiler flags, the APP team achieved a speedup of 2.5x for a small 3D case and 1.85x for a medium-sized 3D case.
- This project supports the goals of the Theory, Modeling, and Simulations (TMS) Program under NASA's Heliophysics Grand Challenges Research Program.

**Mission Impact**: Improvements in code accuracy and performance support an enhanced capability to predict and specify the radiation and plasma environment for satellites orbiting the Earth.



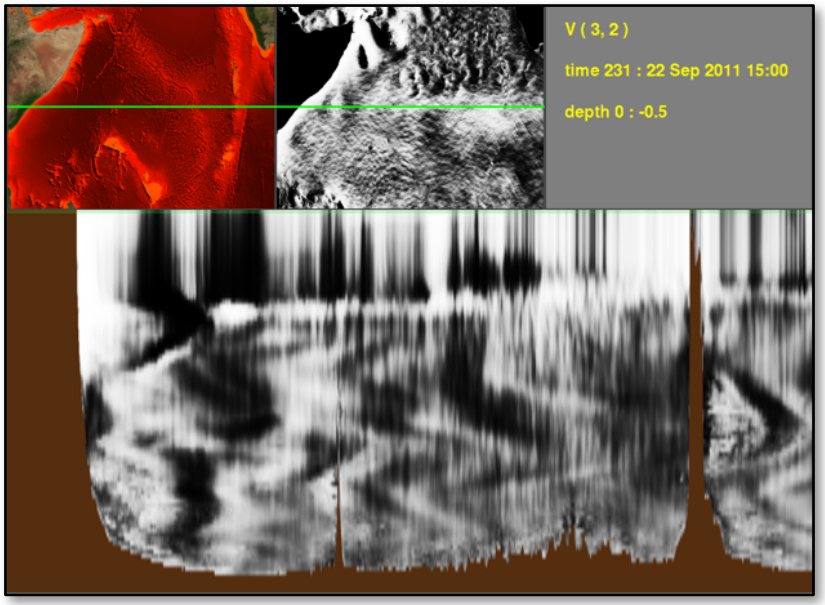

Contours of the magnetic field strength with magnetic field lines zoomed to the near-tail region of Earth's magnetosphere.

***POC***: Daniel Kokron, daniel.s.kokron@nasa.gov, NASA Advanced Supercomputing (NAS) Division, CSRA LLC

# Vertical Slice Feature Added to ECCO Ocean Visualization Application

- The HECC visualization team members enhanced the application they created for visualizing the MITgcm/ECCO (Estimating the Circulation and Climate of the Ocean) data.
- The application previously showed only horizontal slices; it can now show a vertical slice through all 90 depths of the data.
- Because calculating the slice is expensive, only one region of the globe can be shown at a time, and 90 different nodes are needed to do the calculations (one node per depth).
- The slice position can be moved interactively, and can show successive time steps at about 24 frames per second.
- The ocean researchers spent several hours using the tool during their most recent visit, and were able to find new vertical stratification.
- The Visualization team expects to further extend the application by volume rendering the data instead of showing a cut through it. Using volume rendering techniques will show 3D structures in the data.

**Mission Impact**: Enabled by HECC visualization tools, ocean scientists are now able to easily see vertical structures in the 1/48$^{th}$ degree simulation output from the ECCO application.



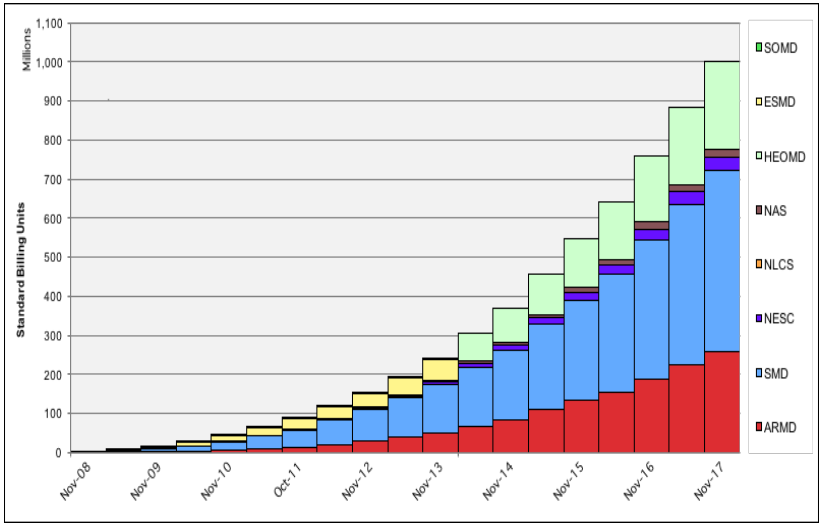

Screen shot of the vertical slice application. Top (left to right): Ocean bathymetry, a map view of the region, and some metadata. Bottom: The selected vertical slice; the slice position is shown in the green line at top.

***POCs***: David Ellsworth, david.ellsworth@nasa.gov, (650) 604-0721, NASA Advanced Supercomputing (NAS) Division, CSRA LLC; Chris Henze, chris.henze@nasa.gov, (650) 604-3959, NAS Division

# Pleiades Surpasses One Billion SBUs Delivered to Users

- NASA's flagship supercomputer, Pleiades, delivered 19,302,726 Standard Billing Units (SBUs) in November, bringing the lifetime total to 1,007,499,069 SBUs delivered to the Mission Directorates (1,002,488,246 charged SBUs and 5,010,823 free SBUs).
- Since its installation in 2008, new technology increased Pleiades' capability by almost a factor of 30, so that while it took 7 years to deliver the first 500 million SBUs, it took only 3 more years to deliver another 500 million.
- Improvements also mean Pleiades currently provides as many SBUs in one month as it did in its first 14-15 months of production.
- Among recent projects using the most computer time on Pleiades: flow computations for the Space Launch System configuration; investigations to reduce the environmental impact of aircraft; and global simulations to help monitor ocean, and atmospheric systems.

The NAS Division's continuous increase in computational capability and capacity is essential for all mission directorates to meet the high demand for supercomputing resources to accomplish their goals and objectives.




Cumulative chart in millions since the first mission directorate jobs ran on Pleiades to November 2017. One hour of computer time is defined as one hour of computing on a 12-core Westmere node. Therefore, the 1-Billion hour milestone is equivalent to delivering 12 billion hours on a Westmere processor core

POC: Catherine Schulbach, catherine.h.schulbach@nasa.gov,
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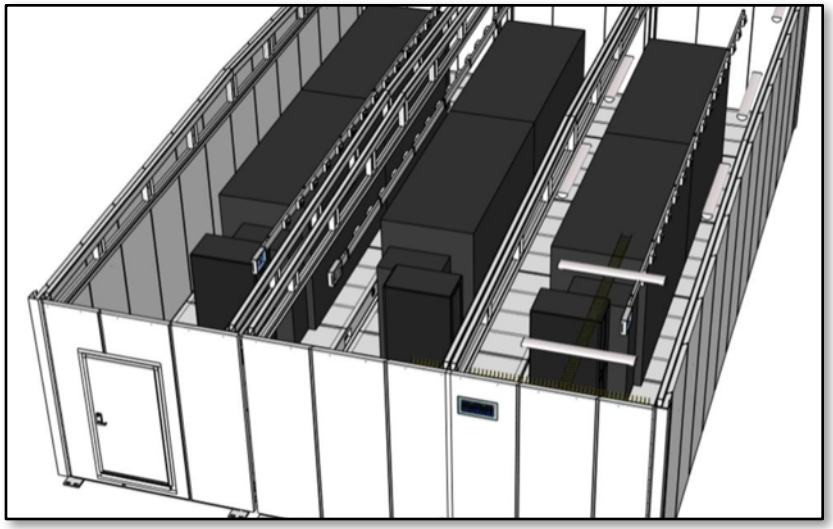
# HPE Selected as Vendor for NAS Facility Expansion Project

- CSRA, which provides services to HECC/NAS under the NASA Supercomputing Support Services contract, selected Hewlett Packard Enterprise (HPE) as the vendor to perform the NAS Facility Expansion (NFE).
- CSRA formed a procurement team that began planning requirements and constraints analysis in October 2016. The government's strong preference was that facility space and compute equipment be acquired from the same vendor so that there would be a single point of contact if issues arose.
- The team subsequently released an RFI and then conducted an Industry Day and one-on-one sessions for interested vendors. In April, they released a Request for Proposal for site improvements together with an initial facility space and computer system.
- Six vendors responded, and after a detailed evaluation by the procurement team, HPE was identified as being the best value to the government.

**Mission Impact**: Expanding its ability to host new computer hardware is a key part of the HECC Project strategy of providing NASA mission directorates with sufficient resources to meet their computing capacity and capability requirements.



Vendor concept of the first NAS Facility Expansion module, together with equipment.

***POC***: Robert Hood, robert.hood@nasa.gov, 650-604-0740, NASA Advanced Supercomputing (NAS) Division, CSRA LLC

# HECC Staff Pilot NASA's 30th Exhibit at Annual Supercomputing Conference

- The HECC team coordinated NASA's presence at SC17, the 30th annual Supercomputing Conference, held November 14–18 in Denver, CO.
- Users from four NASA locations, along with university and corporate collaborators, presented results of 37 science and engineering projects enabled by Pleiades, Electra, and Discover and supported by HECC & NCCS visualization, optimization, and network experts.
- Featured demos highlighted for attendees included:
  - Complex CFD simulations to study the causes of dynamic stall during rotorcraft flight to improve efficiency and safety.
  - A global simulation of meteorology and atmospheric chemistry that captures shifting patterns of ozone and other chemical compounds.
  - Revolutionary modeling and simulation techniques for design of complex planetary entry missions for next-generation spacecraft.
  - Global 3D models and high-resolution scientific visualization of the sun's magnetic field to predict the effects of space weather.
- A wide array of stunning images and movies of science and engineering simulations, many created by HECC visualization experts (see slide 4), were shown on the 10x6-foot hyperwall; more than 150 images and 20 videos were made available on the NASA@SC17 website (see slide 7).
- Ames Center Director Eugene Tu, along with Rupak Biswas and Piyush Mehrotra, had the opportunity to meet twice with SC17 General Chair Bernd Mohr to explore how NASA can expand its high-level participation in future SC conferences.

*Visit the NASA@SC17 website at: www.nas.nasa.gov/SC17*

**Mission Impact**: SC17 provided a highly visible public platform to showcase NASA science and engineering missions supported by the agency's high-end computing resources, as well as NASA's latest research and advances in HPC technologies.

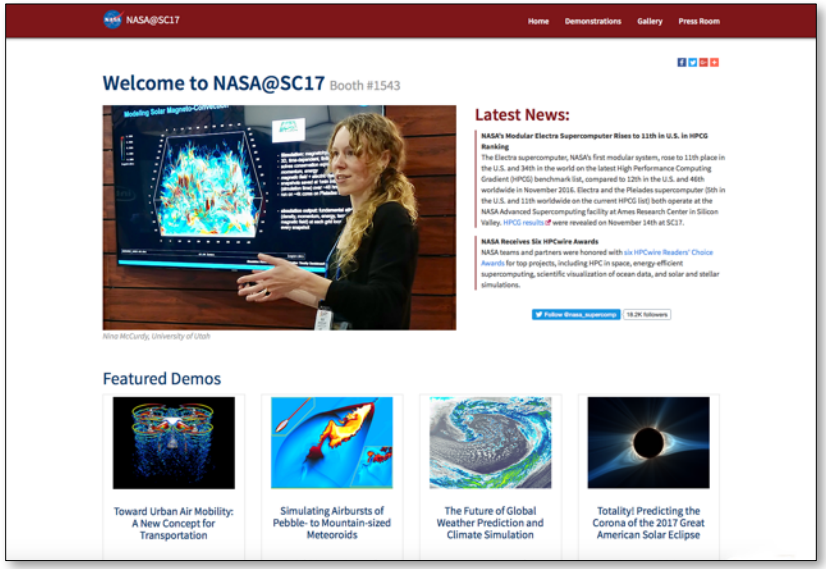

NASA Ames Center Director, Eugene Tu (front row, 4th from right) is flanked by the NASA support team and presenters who worked to give attendees a great experience at the SC17 conference.

***POC***: Gina Morello, gina.f.morello@nasa.gov, (650) 604-4462, NASA Advanced Supercomputing Division

# Tools Team Spotlights NASA Presence at SC17 Conference

- The HECC Tools team worked closely with the Pubs Media team to gather and present content from HECC users who gave demonstrations at the SC17 conference in Denver, CO.
- The Tools team creates, updates, and maintains internal and public-facing websites that support NASA's presence each year at the supercomputing conference. These include:
  - A content upload site, where the researchers associated with each demonstration transmit their text, images, and videos to the Pubs Media team.
  - A website that drives the overhead schedule screen in the NASA booth. Scripts pull data from a Google calendar with information on over 100 booth events. The calendar also supplies data to schedule pages on the main NASA@SC17 website, enabling scheduling changes during the conference to be reflected everywhere within moments.
  - The main NASA@SC17 website, which draws visitors from the HPC community, the media, and the public. This year, the tools team made several improvements to the site, including: updated home page design features to draw attention to new content during the conference, and a new "Tweet Grid" visual display to highlight the most popular NASA SC17 posts.
- The NASA@SC17 website has already received more than 10,000 unique visitors from all over the world, and traffic continues to grow. Images and videos from the site were picked up by publications such as *Wired* and *Aviation Week*.

**Mission Impact**: NASA@SC websites call attention to the agency's supercomputing, science, and engineering outreach activities before, during, and after the annual supercomputing conference.




The NASA@SC17 website features more than 150 images and 20 videos taken from 37 demonstrations presented in the NASA booth. Each demonstration has its own page on the site to explain the details, results and impact of the research. Supercomputing related news and information were updated by the Tools team throughout the conference.
See: https://www.nas.nasa.gov/SC17

***POC***: John Hardman, john.hardman@nasa.gov, (650) 604-0417, NASA Advanced Supercomputing Division, CSRA LLC

# Tools Team Deploys Oracle Enterprise Manager (EM) 13C

- The HECC Tools Team completed the transition and consolidation of Oracle EM 12C on the Oracle production and development systems into a single Oracle EM 13C version. This transition provides the following benefits:
  - Reduces time to manage the Oracle administration tasks by providing a single Oracle EM system for backup, restore and admin tasks.
  - Reduces the time to maintain the Oracle EM software with the latest security patches.
  - Increases the performance of the Oracle database server by freeing up CPU resources.
- This project also included the securing of the EM 13C server with a host certificate and the connection between agents running with the Agents host certificate.

**Mission Impact**: The HECC Oracle databases are now administered with the latest Enterprise Management version, providing the latest features to the HECC services.


Oracle Enterprise Manager 13C provides the database administrator with improved maintenance processes to ensure common activities across development and production systems.

***POC***: Mi Young Koo, mi.y.koo@nasa.gov, (650) 604-4528, NASA Supercomputing Division, CSRA LLC

# ESS Team Focuses HECC Infrastructure Operations Support on OS Upgrades

- HECC's Engineering Servers and Services (ESS) team focused its efforts over the last six months on continuing to upgrade ~350 Linux servers and workstations to Red Hat 7 (46% complete) and completing the macOS 10.12 Sierra upgrade on ~200 Macs.
- Other projects worked by ESS include:
  - Deployed 27 new servers (including 18 virtual machines) and removed 15 servers.
  - Applied 66 unique patch sets (12 Mac, 46 Linux, 8 Windows) to the ESS supported systems.
  - Completed security plan updates, security controls review and updates, and contingency plan testing for the NAS Security Plan.
  - Tested and started deployment of the Code42 CrashPlan application to replace ASG Time Navigator for Mac backups.
  - Built and supported systems for the SC17 conference booth, deployed the new NASA banner on websites and systems, removed KACE from systems, and developed and deployed FileVault password expiration enforcement scripts.
  - Started review of macOS 10.13 High Sierra.
  - Continued consulting with NASA Ames divisions about PIV-M on the Macs.

**Mission Impact**: Operating system upgrades and patching updates are critical to successful operations and security of the HECC infrastructure systems.

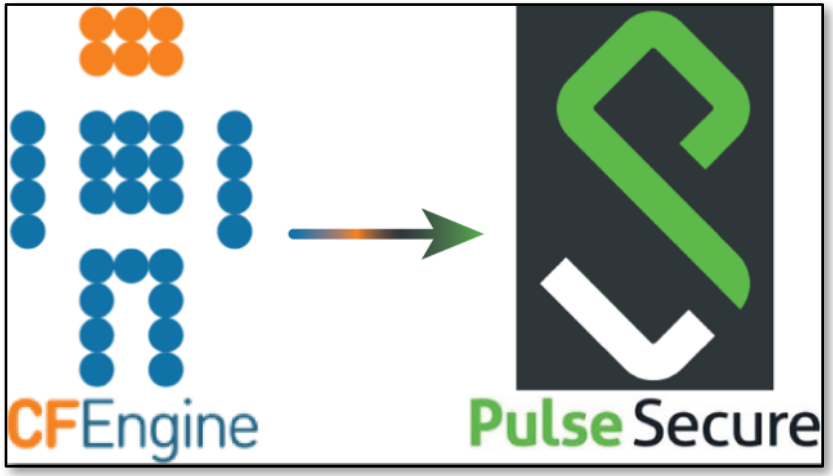

The Engineering Servers and Services team continues to research new applications and maintain current operating systems to ensure optimal operations of the HECC infrastructure services.

***POC***: Robert Shaw, robert.c.shaw@nasa.gov, (650) 604-4354, NASA Supercomputing Division, CSRA LLC

# ESS Integrates CFEngine Control Over VPN

- CFEngine is one of the major tools used by the ESS team to maintain HECC/NAS workstations. The primary role of CFEngine is to manage hundreds of custom configurations, and enforce security controls for the NAS Security Plan.
- Previously, CFEngine was restricted to the NASLAN high-speed network due to host resolution dependencies that caused systems to lose custom configurations while on dynamic networks such as VPN.
- ESS overcame technical barriers by:
  - Leveraging the Jamf Pro enterprise mobility management tool to assign hard classes to each system that represents their unique identity rather than relying on DNS resolution.
  - Modifying network configurations to allow access to the CFEngine server from VPN.
- ESS is now working on CFEngine support for macOS High Sierra.

**Mission Impact**: CFEngine access over the virtual private network allows for better control over HECC/NAS systems and helps prevent remote users from becoming vulnerable due to stale configurations.




The open source CFEngine tool is now integrated with the NAS virtual private network (VPN) client application, Pulse Secure.

***POC***: Ted Bohrer, theodore.w.bohrer@nasa.gov, (650) 604-4335, NASA Supercomputing Division, ADNET Systems

# Harnessing the Power of Pleiades to Uncover the Sun's Swirling Jets

- Scientists at Lockheed Martin's Solar & Astrophysics Lab and the University of Oslo used the massively parallel capabilities of Pleiades to better understand how the Sun's atmosphere is shaped and heated, and how it impacts Earth.
  - The project used advanced, multi-dimensional radiative magnetohydrodynamic (MHD) simulations to take into account the complex physical processes that power the Sun's atmosphere.
  - The science team compared the properties of simulated features, such as jets, with real features in the solar atmosphere observed with NASA's IRIS observatory and the Swedish Solar Telescope.
  - For the first time, they showed how the jets naturally occur in simulations of the solar atmosphere.
- By comparing the simulation results with images and spectra taken by IRIS, they were able to explain some of the mission's puzzling findings; e.g., how small-scale magnetic fields can release energy and mass that impact the lower solar atmosphere, or chromosphere.
- The team is producing new simulations that improve the physical processes playing a role in the solar atmosphere, which will better resolve some of intriguing features observed in the Sun.

*HECC provided supercomputing resources and services in support of this work.*

**Mission Impact**: Scientists use the massively parallel capabilities of the Pleiades supercomputer for running magnetohydrodynamics simulations and for performing detailed calculations of the radiation emerging from the simulations.

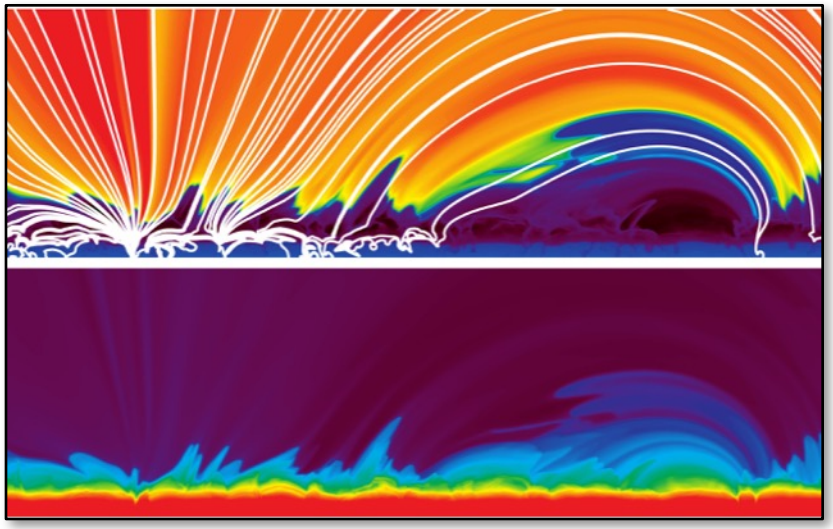


Image from a time-evolving simulation of the solar atmosphere from a 2.5-dimensional magnetohydrodynamic model. Top panel: logarithm of temperature with overlapping magnetic field lines; bottom panel: logarithm of density.

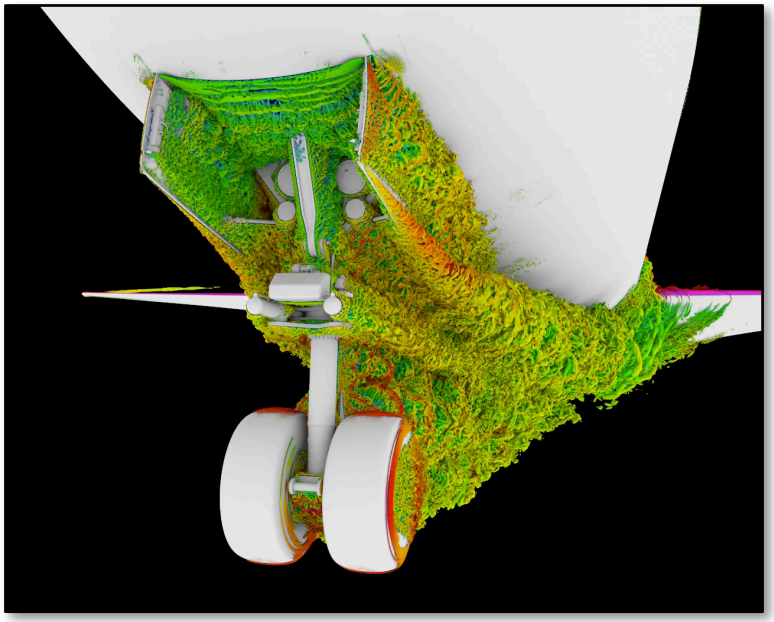
***POCs***: Juan Martínez Sykora, juanms@lmsal.com, Lockheed Martin Solar & Astrophysics Laboratory; Tiago Pereira, tiago.pereira@astro.uio.no, University of Oslo

# Pleiades Simulations Enable Progress in Airframe Noise Analysis and Prediction

- Aerospace engineers at Langley Research Center, in partnership with the Boeing Company, ran high-fidelity simulations on Pleiades to investigate the complex, unsteady flow field around the nose landing gear of a full-scale Boeing 777.
- The simulations were run to obtain greater insight into the sources of airframe noise—a major factor in the total noise generated by aircraft during approach and landing.
- The intricate landing gear systems of large civil aircraft produce very complex flow fields that are nonlinear and highly interactive. In this project, the researchers:
  - Accurately computed the far-field noise signature of the full-scale nose landing gear.
  - Validated the predicted results against measured acoustic data obtained from flight tests of the aircraft.
- High-fidelity, simulation-based airframe noise prediction for full-scale, complete, large civil aircraft in landing configuration is a grand challenge for the aerospace community. Results of this project constitute a promising initial attempt to meet this grand challenge.

*HECC provided supercomputing resources and services in support of this work.*

**Mission Impact**: HECC resources enable simulation-based prediction of airframe noise, essential for designing practical noise reduction strategies—a key goal of the Aeronautics Research Mission Directorate.



Simulated flow field around the nose landing gear of a Boeing 777. This video shows an isosurface of lambda-2, a property derived from the gradient of the flow velocity, colored by magnitude. A strong rotating flow can be seen coming off the edge of the landing-gear doors. *Patrick Moran, NASA/Ames* (**View in Slide Show mode and click image for full video.**)

***POC***: Mehdi Khorrami, mehdi.r.khorrami@nasa.gov, (757) 864-3630, NASA Langley Research Center

# HECC Facility Hosts Several Visitors and Tours in November 2017

- HECC hosted 3 tour groups in November; guests learned about the agency-wide missions being supported by HECC assets, and some groups also viewed the D-Wave 2X quantum computer system. Tour count this month is low due to the Division staff participation at SC17. Visitors this month included:
  - Reed S. Cordish, Assistant to the President for Intragovernmental and Technology Initiatives, toured Ames, including a demo on the NAS hyperwall and tour of the quantum computer room.
  - Bruce Ralston and Fazil Mihlar, Minister and Deputy Minister of British Columbia Jobs, Trade & Technology, were invited guests of David Bell, Director, Universities Space Research Association at Ames, to view the D-Wave system and laboratory; they also received a HECC demo and computer room tour by Stuart Rogers.
  - Several chiefs of staff from NASA headquarters and chiefs of staff from all centers were at Ames for face-to-face meetings; they received briefings and tours of several Ames facilities, including NAS.

NAS Division Computational Aerosciences Branch Chief, Cetin Kiris (far right), gave a tour of the supercomputing facility to a group of NASA chiefs of staff, who were at Ames for face-to-face meetings.

***POC***: Gina Morello, gina.f.morello@nasa.gov, (650) 604-4462, NASA Advanced Supercomputing Division

# Papers

- "**Three-Dimensional GRMHD Simulation of Neutrino-Cooled Accretion Disks from Neutron Star Mergers**," D. Siegel, B. Metzger, arXiv:1711.00868 [astro-ph.HE], November 2, 2017. * *https://arxiv.org/abs/1711.00868*
- "**Validation of Small Kepler Transiting Planet Candidates In or Near the Habitable Zone**," G. Torres, et al., arXiv:1711.01267 [astro-ph.EP], November 3, 2017. * *https://arxiv.org/abs/1711.01267*
- "**Formulation of Optimal Surrogate Descriptions of Fuels Considering Sensitivities to Experimental Uncertainties**," P. Govindaraju, M. Ihme, Combustion and Flame, vol. 188, February 2018 (available online November 5, 2017). * *https://www.sciencedirect.com/science/article/pii/S0010218017303826*
- "**Deflections of UHECRs in the Galactic Magnetic Field**," G. Farrar, M. Sutherland, arXiv:1711.02730 [astro-ph.HE], November 7, 2017. * *https://arxiv.org/abs/1711.02730*
- "**The Vertical Dust Profile Over Gale Crater, Mars**," S. Guzewich, et al., Journal of Geophysical Research: Planets, November 8, 2017. * *http://onlinelibrary.wiley.com/doi/10.1002/2017JE005420/full*
- "**Dynamical Origin and Terrestrial Impact Flux of Large Near-Earth Asteroids**," D. Nesvorny, F. Roig, arXiv:1711.04023 [astro-ph.EP], November 10, 2017. * *https://arxiv.org/abs/1711.04023*
- "**Creating Aerosol Types from CHemistry (CATCH): A New Algorithm to Extend the Link Between Remote Sensing and Models**, " K. Dawson, et al., Journal of Geophysical Research: Atmospheres, November 26, 2017. * *http://onlinelibrary.wiley.com/doi/10.1002/2017JD026913/full*

** HECC provided supercomputing resources and services in support of this work.*

# Presentations


- **2017 Supercomputing Conference**, Denver, Colorado, November 12-17, 2017
  - "**Reducing Soot Emissions from Jet Engines**," A. Chong, V. Raman *
    *https://www.nas.nasa.gov/SC17/demos/demo1.html*
  - "**Ahead by More Than a Nose: Progress in Airframe Noise Analysis and Predictions**," M. Khorrami. *
    *https://www.nas.nasa.gov/SC17/demos/demo2.html*
  - "**3D Heat Shield Simulations for Designing Future Space Vehicles**," J. Meurisse, N. Mansour. *
    *https://www.nas.nasa.gov/SC17/demos/demo3.html*
  - "**Lattice Boltzmann for Airframe Noise Predictions**," M. Barad, C. Kiris. *
    *https://www.nas.nasa.gov/SC17/demos/demo4.html*
  - "**Toward Urban Air Mobility**," P. Ventura Diaz, S. Yoon. *
    *https://www.nas.nasa.gov/SC17/demos/demo5.html*
  - "**Simulating the X-57 Electric Concept Aircraft**," J. Duensing, C. Kiris. *
    *https://www.nas.nasa.gov/SC17/demos/demo6.html*
  - "**Predicting Aircraft Noise and Spacecraft Acoustic Loads**," C. Kiris, F. Cadieux. *
    *https://www.nas.nasa.gov/SC17/demos/demo7.html*
  - "**Algorithm Development for a Many-Core HPC Landscape**," A. Walden, M. Zubair, E. Nielsen. *
    *https://www.nas.nasa.gov/SC17/demos/demo8.html*
  - "**Simulating Next-Generation Clean, Sustainable Jet Fuels**," J. Labahn, M. Ihme. *
    *https://www.nas.nasa.gov/SC17/demos/demo9.html*

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# Presentations (cont.)

- **2017 Supercomputing Conference (cont.)**
  - "**Keeping Astronauts Safe: Predicting Vibrations on the Launch Abort Vehicle**," F. Cadieux, C. Kiris. *
    *https://www.nas.nasa.gov/SC17/demos/demo10.html*
  - "**Building Aerodynamic Databases for the SLS Design Process**," H. Lee, S. Rogers. *
    *https://www.nas.nasa.gov/SC17/demos/demo11.html*
  - "**Interactive Exploration of Solar Magnetic Field Lines**," N. McCurdy, P. Moran. *
    *https://www.nas.nasa.gov/SC17/demos/demo12.html*
  - "**$XCO_2$ Measured from OCO-2**," C. Cheng, A. Eldering. *
    *https://www.nas.nasa.gov/SC17/demos/demo13.html*
  - "**Scientists Explore Ocean Currents Through Petascale Simulations and Visualizations**," C. Hill, D. Menemenlis. *
    *https://www.nas.nasa.gov/SC17/demos/demo14.html*
  - "**Studying Convection in Stars like Our Sun**," B. Brown. *
    *https://www.nas.nasa.gov/SC17/demos/demo15.html*
  - "**Totality! Predicting the Corona of the 2017 Great American Solar Eclipse**," R. Caplan, C. Downs. *
    *https://www.nas.nasa.gov/SC17/demos/demo16.html*

** HECC provided supercomputing resources and services in support of this work.*

# Presentations (cont.)


- **2017 Supercomputing Conference (cont.)**
  - "**Uncovering the Sun's Swirling Jets**," T. Pereira, J. Martinez Sykora. * *https://www.nas.nasa.gov/SC17/demos/demo17.html*
  - "**Assessing and Analyzing Energy Usage of NASA Workloads on HPC Systems**," R. Hood, H. Jin. *https://www.nas.nasa.gov/SC17/demos/demo18.html*
  - "**Quantum Computing Research at NASA**," E. Rieffel, R. Biswas. *https://www.nas.nasa.gov/SC17/demos/demo19.html*
  - **NASA Blazes a Different Path to Energy-Efficient Supercomputing**," W. Thigpen. *https://www.nas.nasa.gov/SC17/demos/demo20.html*
  - "**Asteroid Impact Risk Assessment**," L. Wheeler, D. Mathias. * *https://www.nas.nasa.gov/SC17/demos/demo21.html*
  - "**Simulating Atmospheric Impacts: From Pebble- to Mountain-Size Meteoroids**," M. Nemec, M. Aftosmis. * *https://www.nas.nasa.gov/SC17/demos/demo22.html*
  - "**Supercomputing Stars**," A. Wray. * *https://www.nas.nasa.gov/SC17/demos/demo23.html*
  - "**Interactive Visualization of High-Dimensional Petascale Ocean Data**," D. Ellsworth. *
  - **PBS Pro Open Source Project Community** (Birds of a Feather)**,** G. Matthews.
  - "**OpenMP Doacross Loops in Practice: A Mini-Application Case Study**," G. Jost.
  - **Common Big Data Challenges in Bio, Geo, Climate, and Social Sciences** (Panel), S. Ganguly.

** HECC provided supercomputing resources and services in support of this work.*

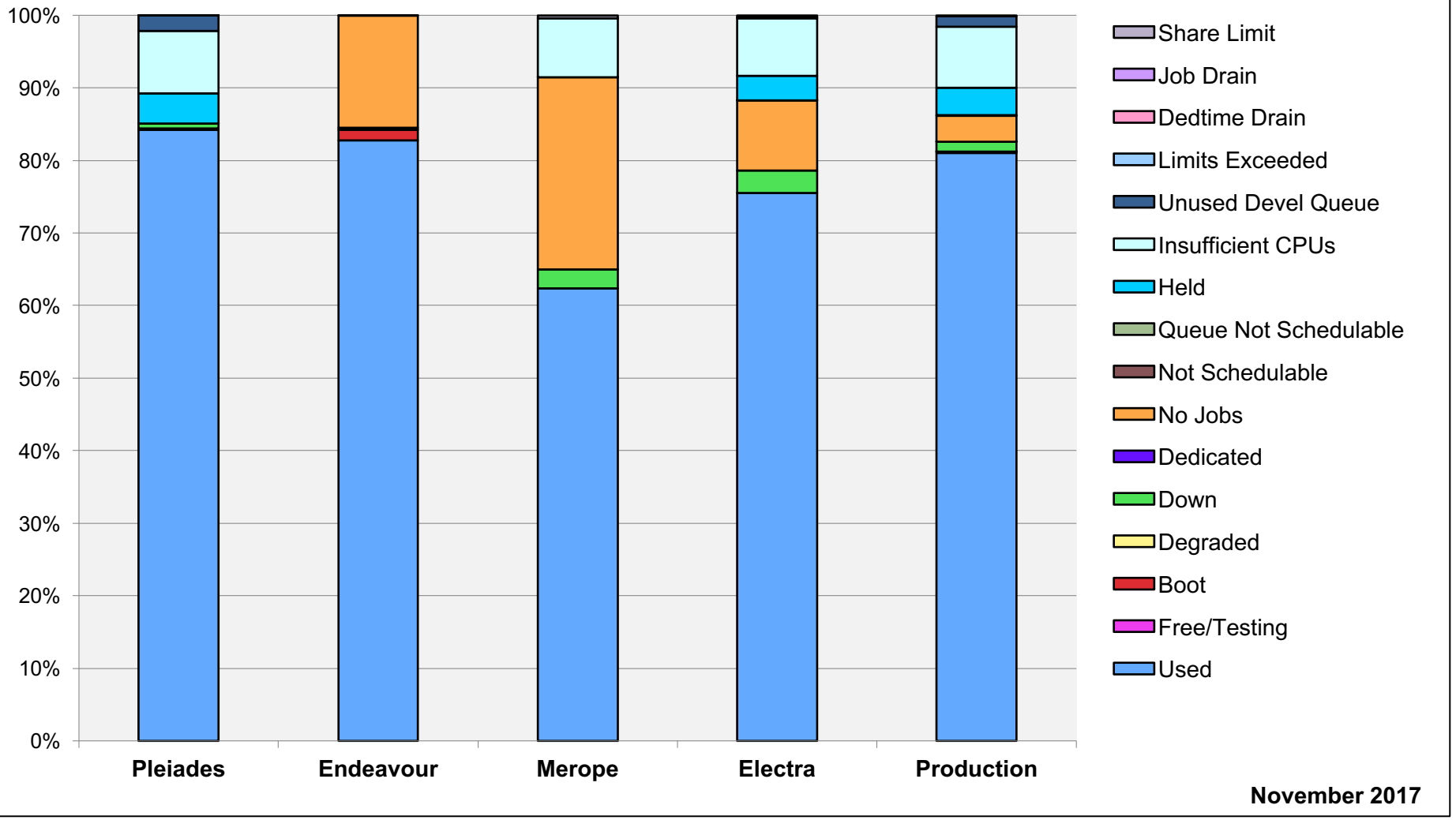
# News and Events

- **7th Annual Discovery Day at AT&T Park (Bay Area Science Festival)**, San Francisco, California, November 11, 2017—As part of NASA Ames Research Center's presence at the event, staff from the NASA Advanced Supercomputing Division joined up with their wind tunnel counterparts to talk about using CFD for sonic boom reduction. *https://www.nasa.gov/feature/nasa-ames-at-the-2017-bay-area-science-festival*
- **NASA to Showcase Science and Technology Advancements at Supercomputing Conference**, *NASA Ames Press Release*, November 7, 2017. *https://www.nasa.gov/ames/press-release/nasa-to-showcase-science-and-technology-advancements-at-supercomputing-conference*
  - **Recently Expanded, NASA's First Modular Supercomputer Ranks 15th in the U.S. on TOP500 List**, *NAS News Item*, November 13, 2017. *https://www.nas.nasa.gov/publications/news/2017/11-13-17.html*
  - **NASA Receives Six HPCwire Readers' Choice Awards at SC17**, *NASA@SC17 News Item*, November 14, 2017. *https://www.nas.nasa.gov/SC17/newsitem_HPCWire_Awards_11-14-17.html*
- **Researchers Explore Aircraft Landing Gear Aerodynamics Through Supercomputer Simulations**, *NASA Ames Image Feature*, November 14, 2017. *https://www.nasa.gov/ames/image-feature/nasa-highlights-simulations-at-supercomputing-conference-like-aircraft-landing-gear*
- **What Good Is a Supercomputer If It Can't Show Off?** *Wired Science Feature*, November 26, 2017—Coverage of the SC17 conference included highlights of several NASA presentations with links to demonstration pages. *https://www.wired.com/story/what-good-is-a-supercomputer-if-it-cant-show-off/*

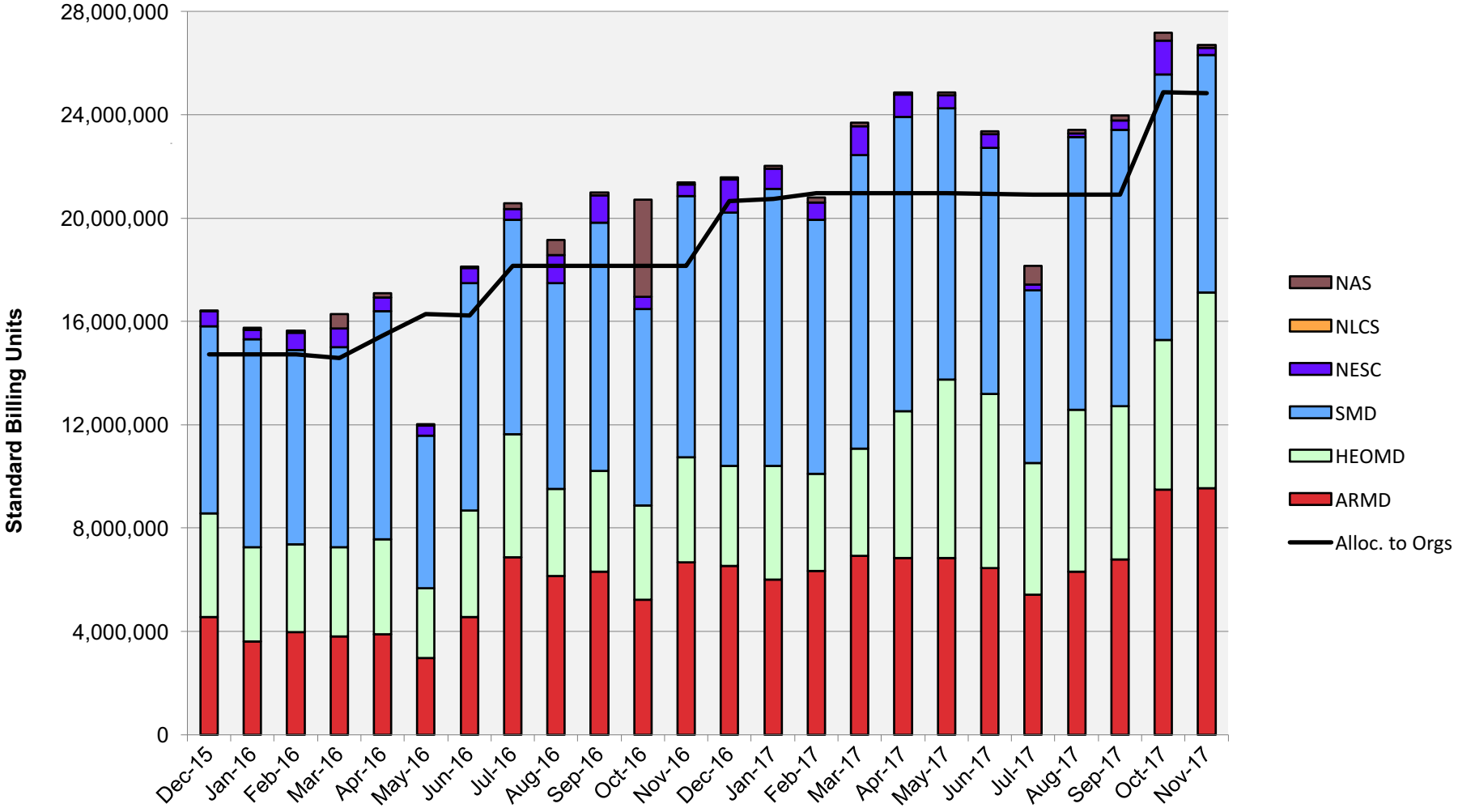
# News and Events (cont.)

- **The Week In Technology, Nov. 27-Dec. 1, 2017: NASA Supercomputers Unlock Flow Secrets**, *Aviation Week Space & Technology Article*, November 27, 2017—Includes coverage of the NAS facility's SC17 aeronautics and asteroid threat assessment presentations enabled by Pleiades, with links to related videos.
  *http://awin.aviationweek.com/ArticlesStory/tabid/975/Status/IPAddress/id/e3185fd8-f971-49ee-a502-cc6994455b78/Default.aspx*

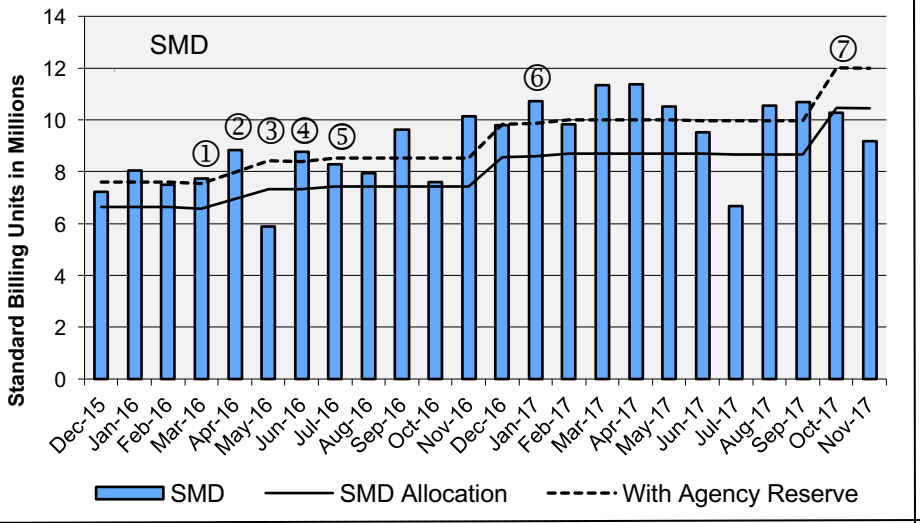
# HECC Utilization

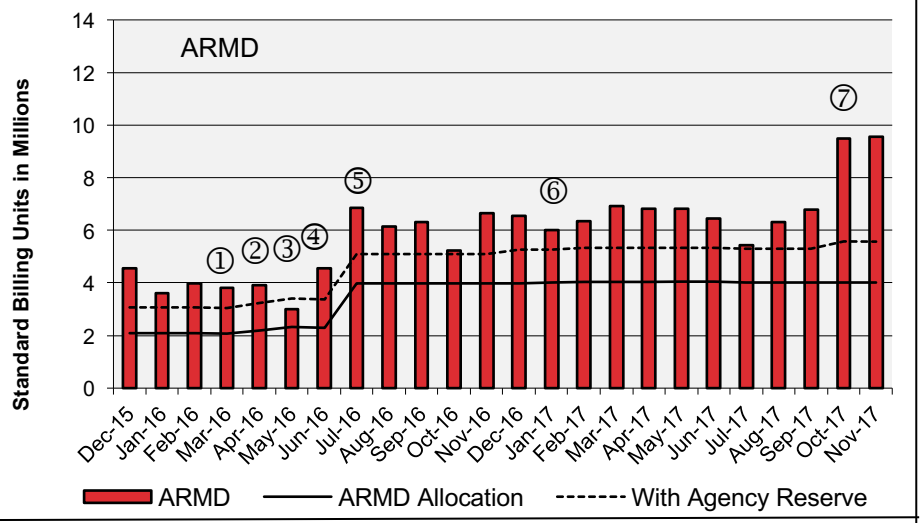


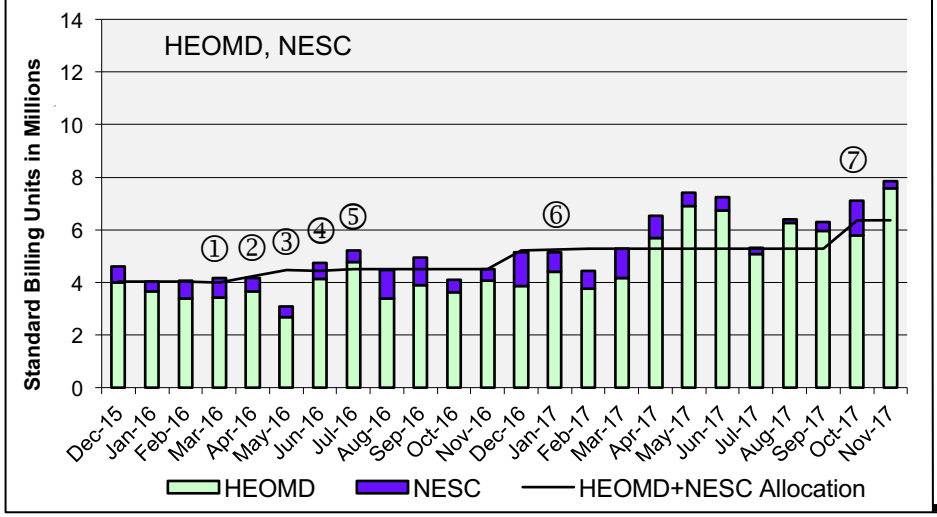
# HECC Utilization Normalized to 30-Day Month



# HECC Utilization Normalized to 30-Day Month

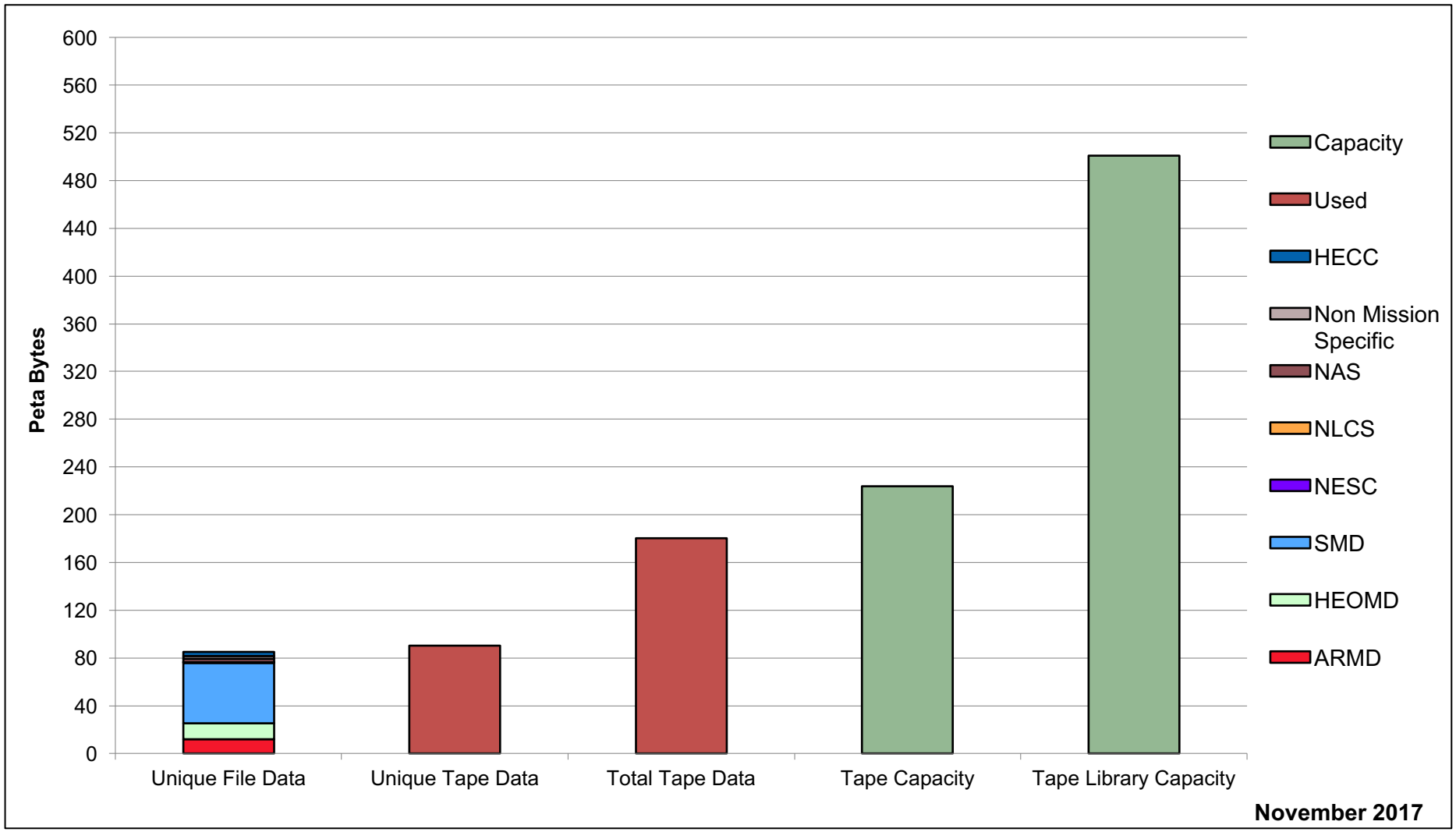


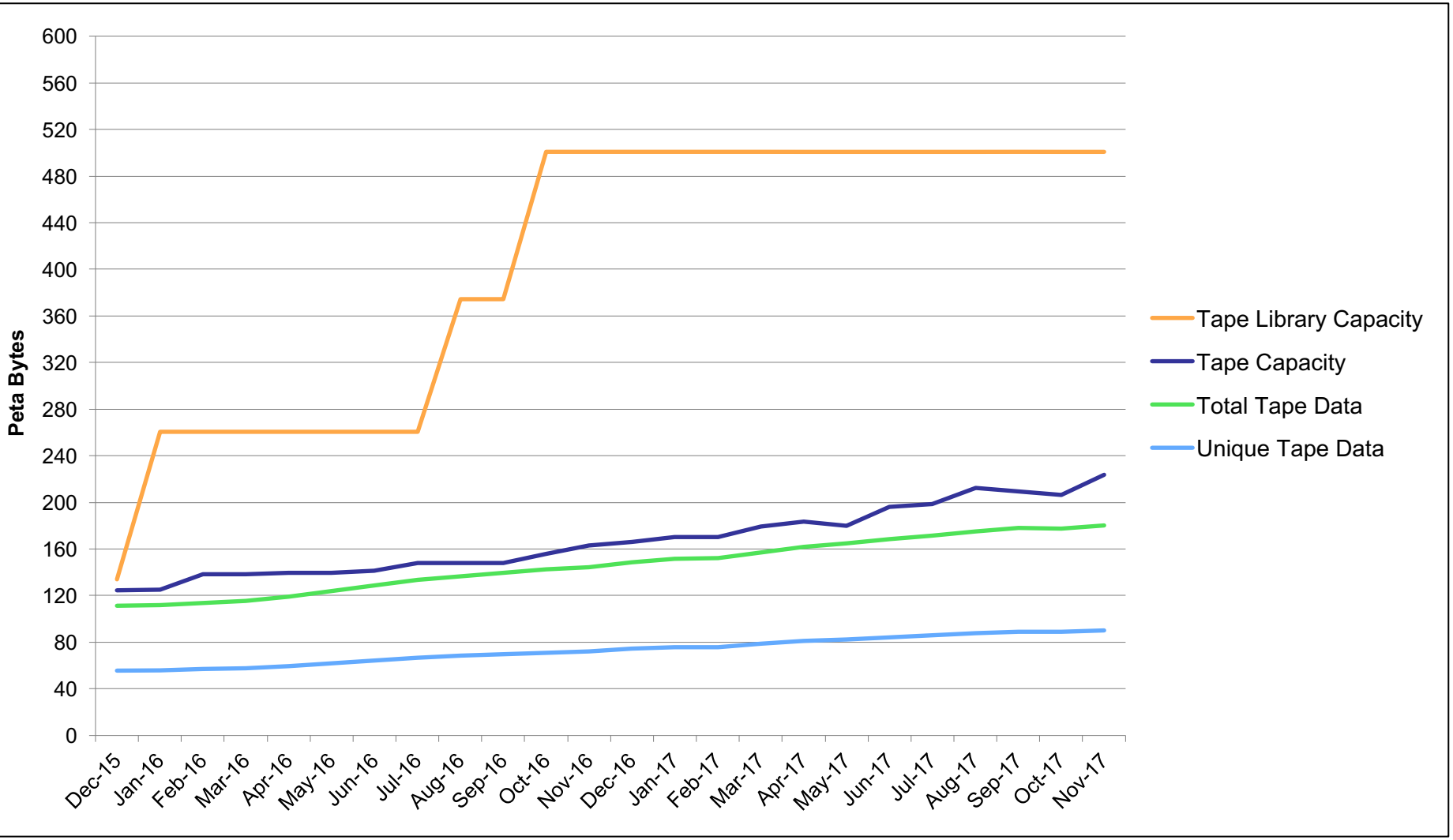




① 16 Westmere racks retired from Pleiades
② 10 Broadwell racks added to Pleiades
③ 4 Broadwell racks added to Pleiades
④ 14 (All) Westmere racks retired from Pleiades
⑤ 14 Broadwell Racks added to Pleiades
⑥ 16 Electra Broadwell Racks in Production, 20 Westmere 1/2 racks added to Merope
⑦ 4 Skylake E Cells (16 D rack equivalents) added to Electra

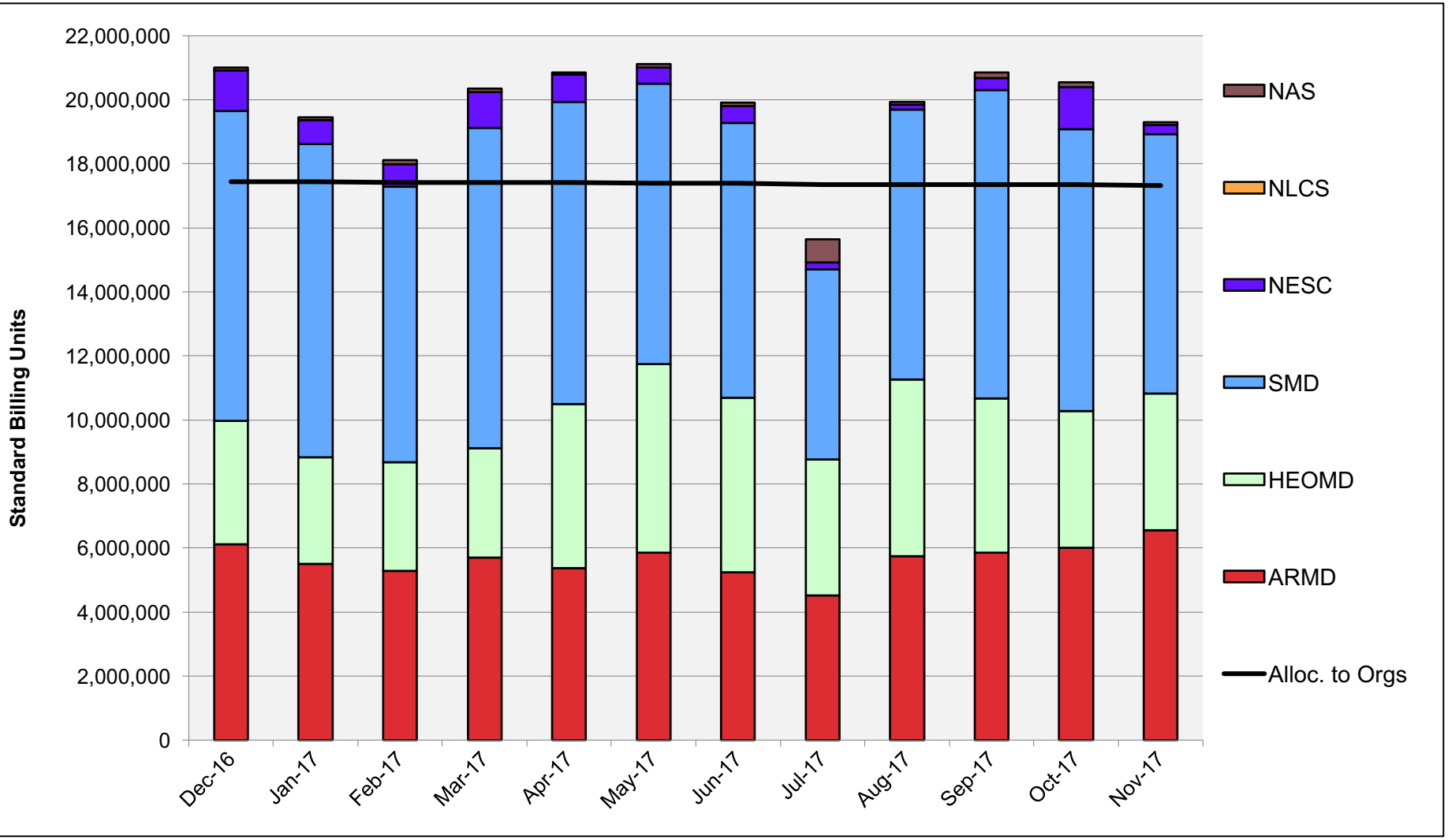
# Tape Archive Status



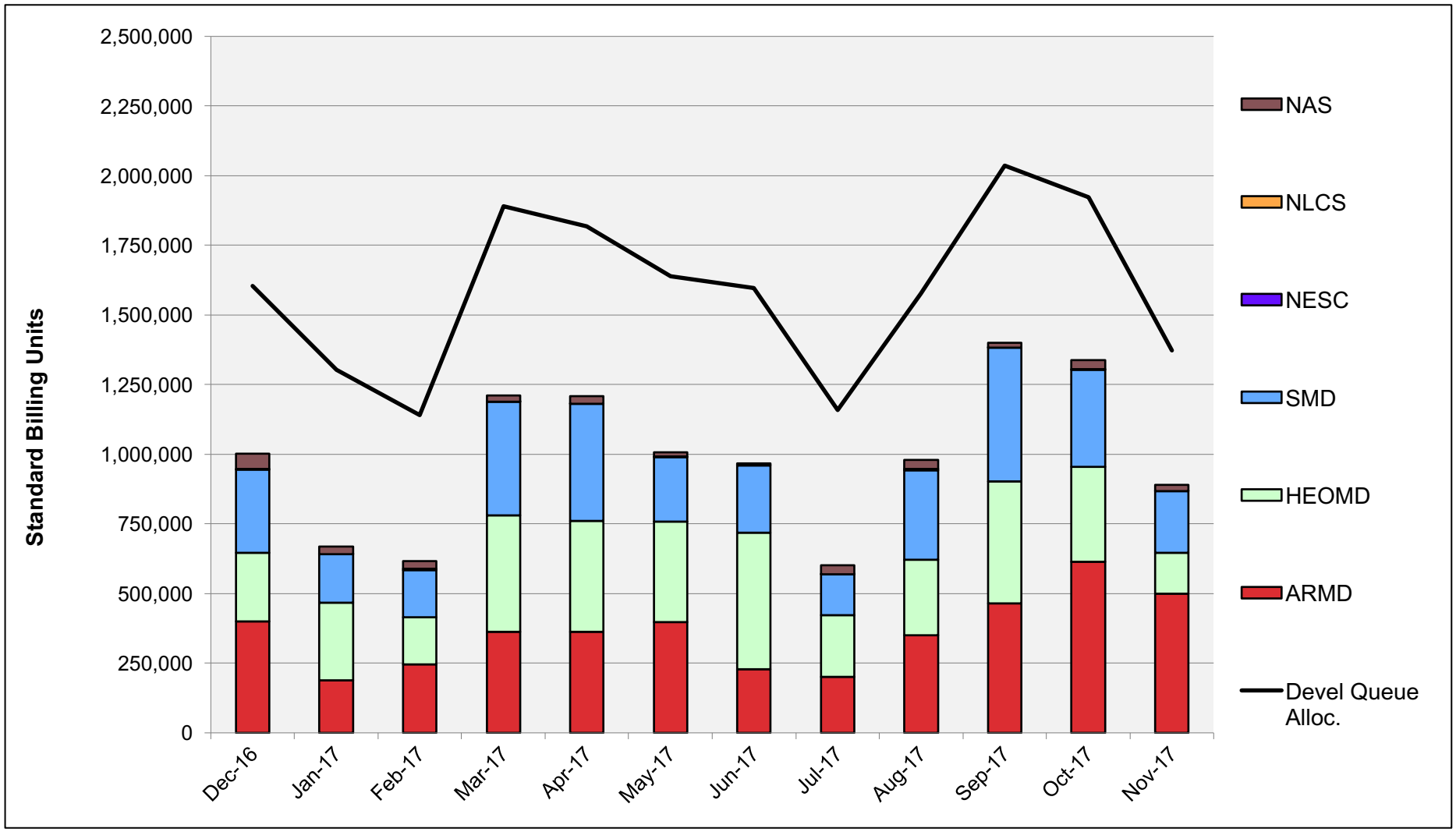
# Tape Archive Status



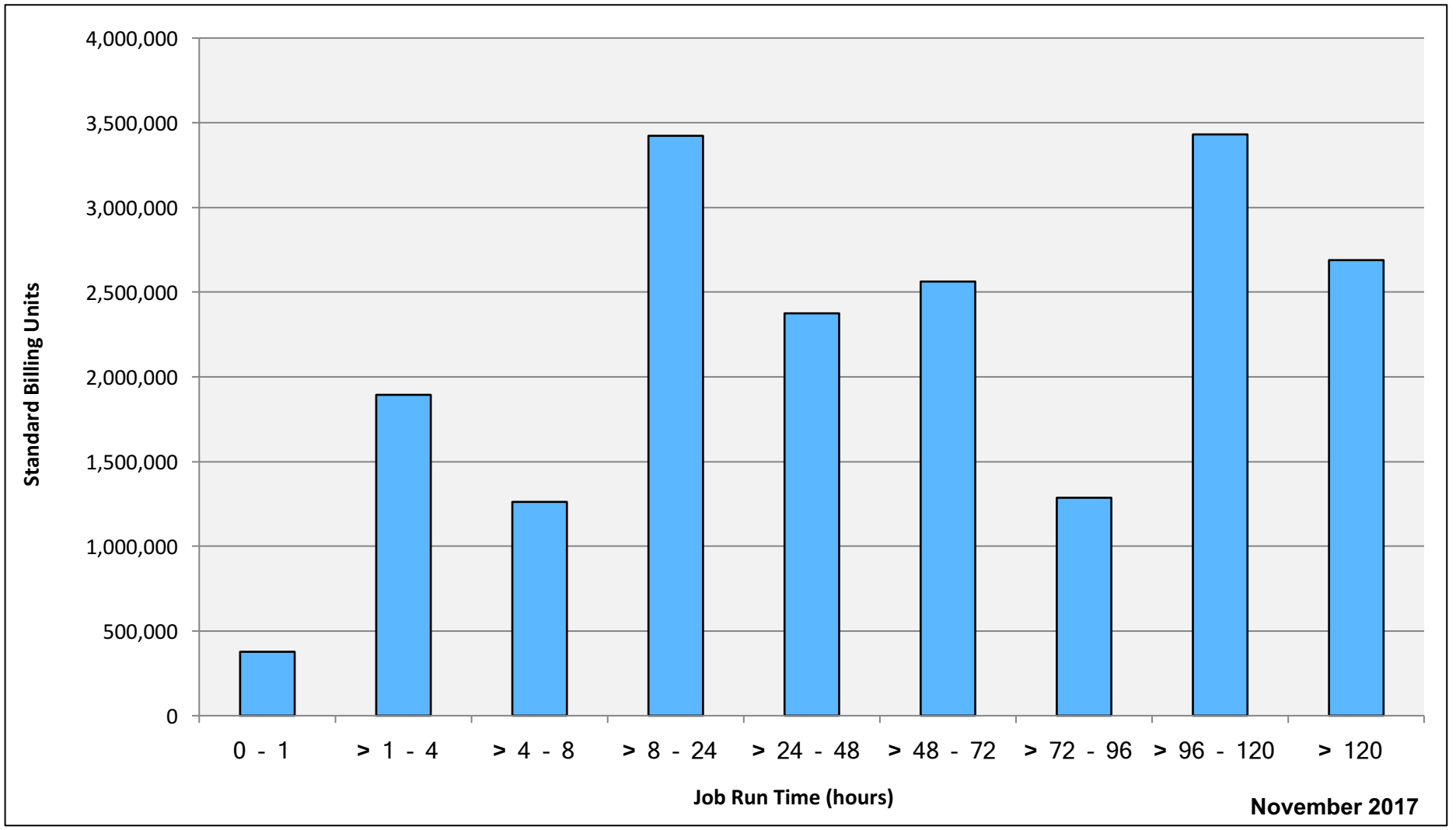
# Pleiades:
# SBUs Reported, Normalized to 30-Day Month



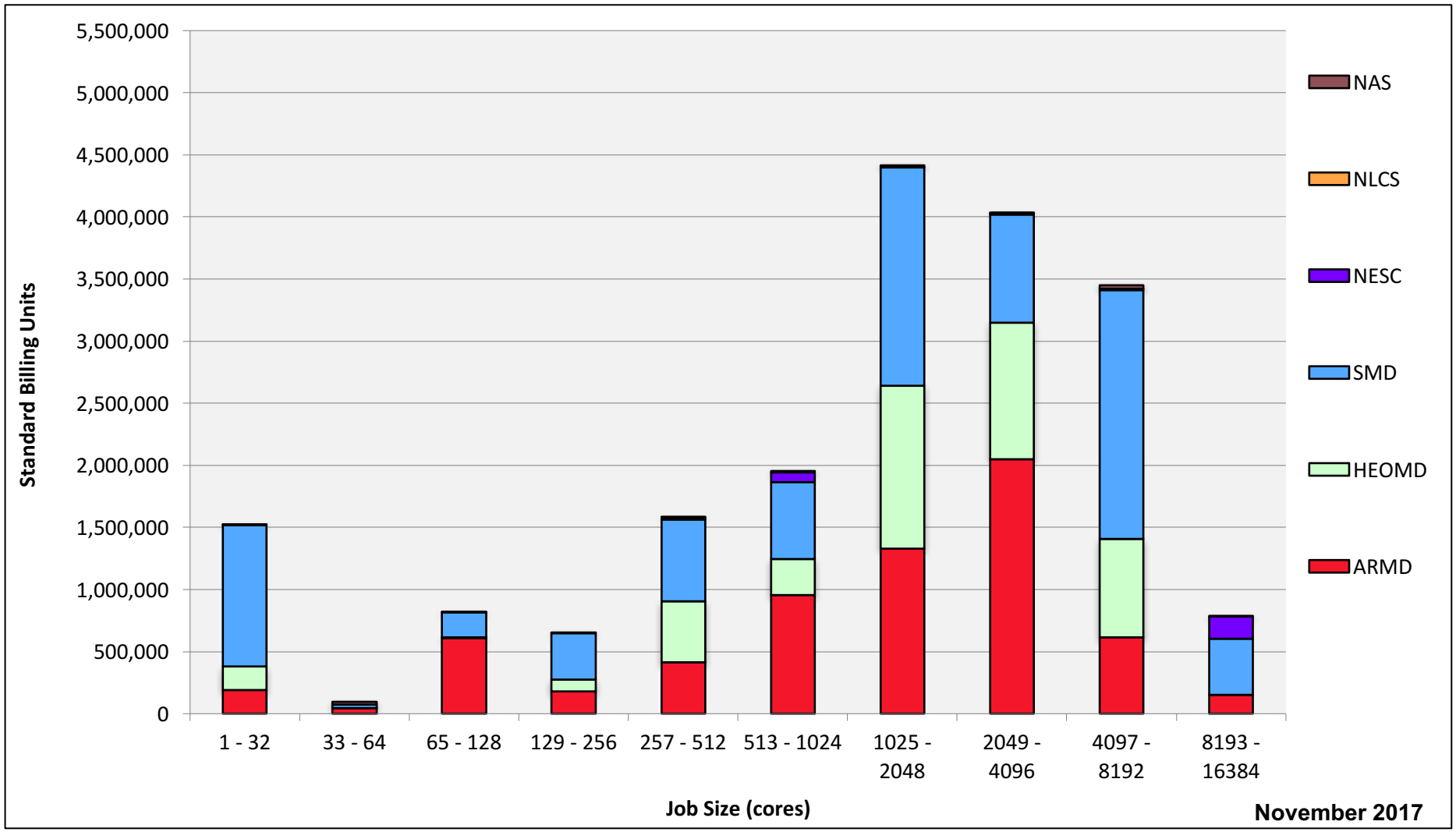
# Pleiades:
# Devel Queue Utilization



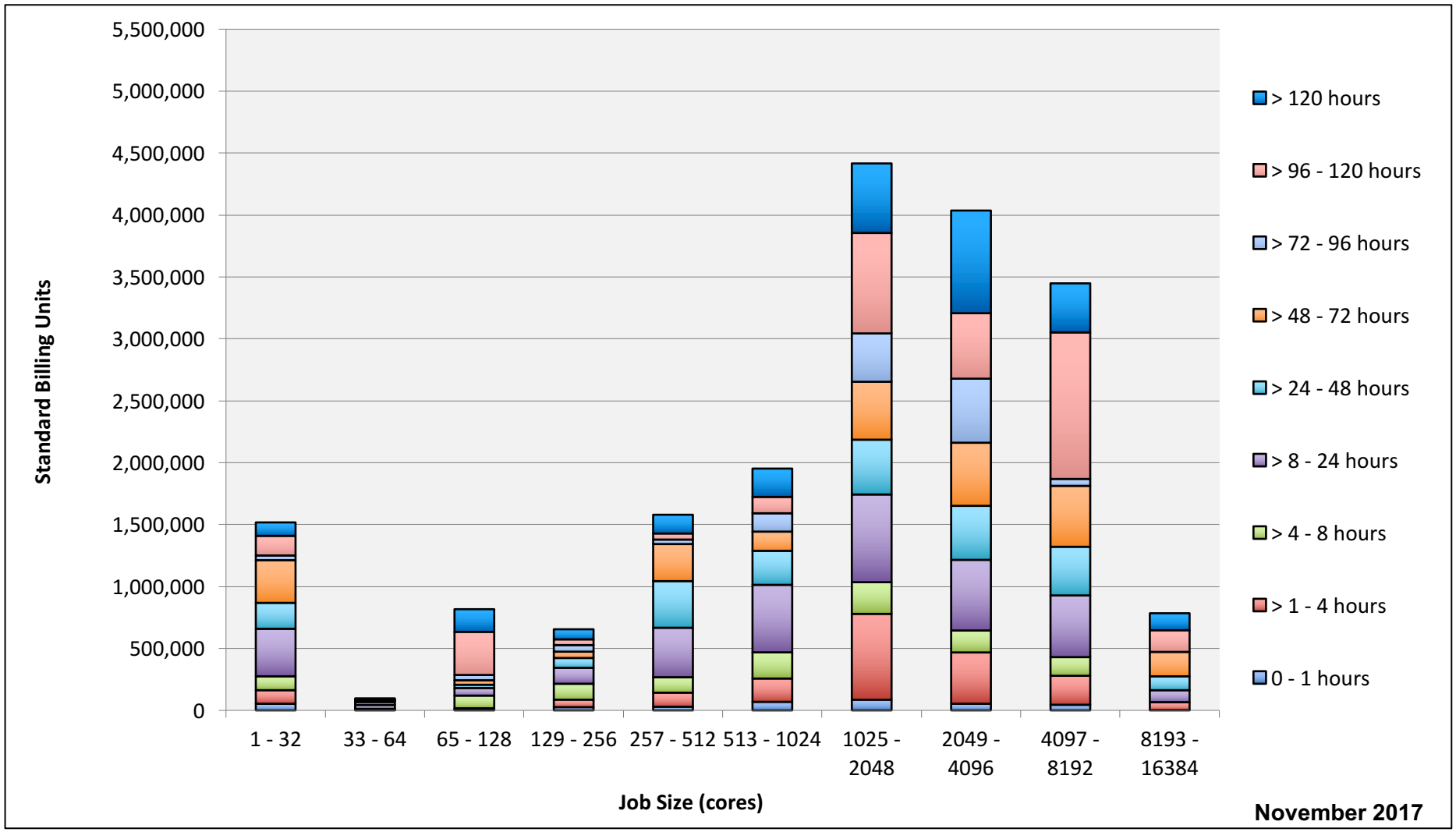
# Pleiades:
# Monthly Utilization by Job Length



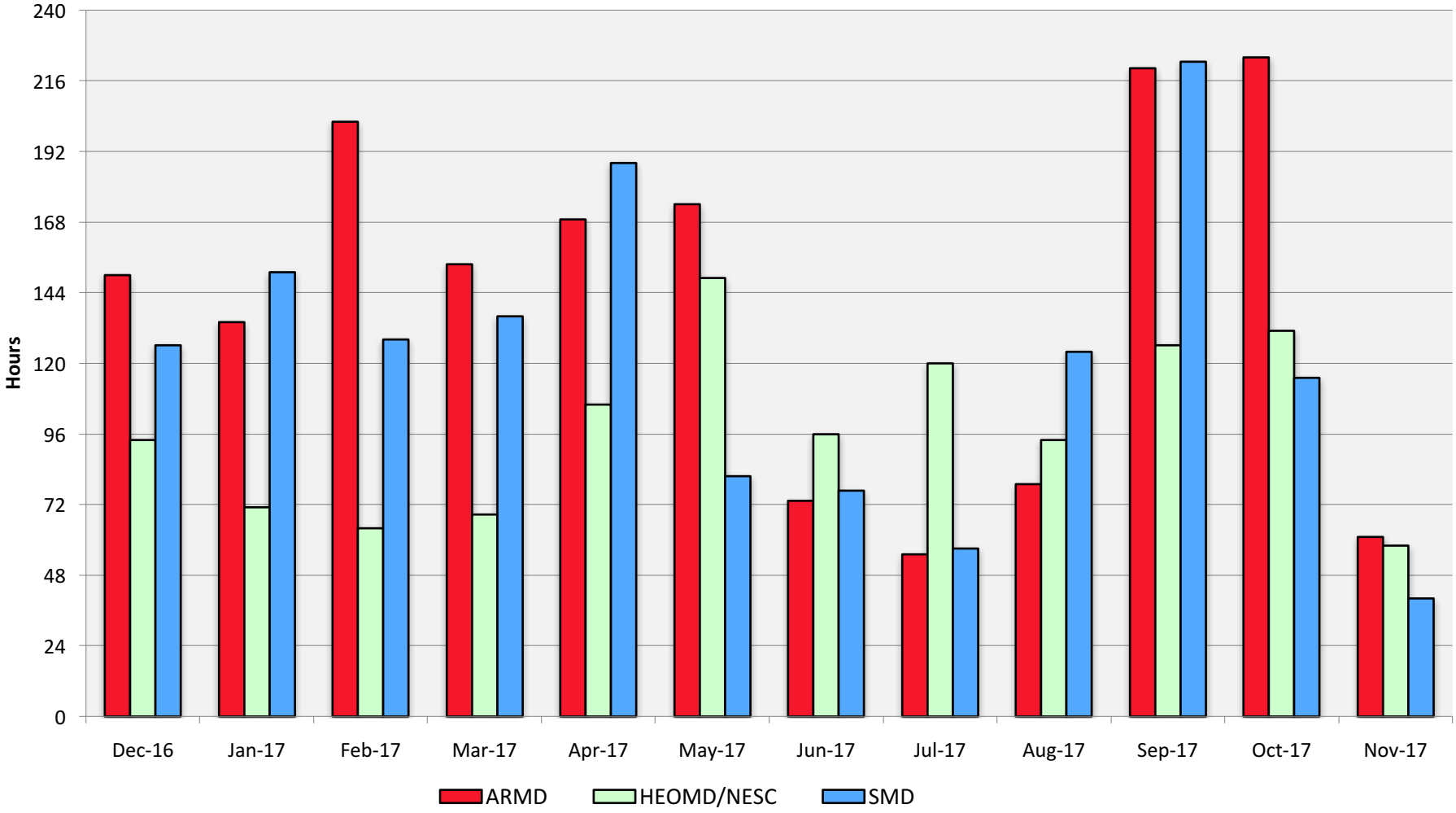
# Pleiades:
# Monthly Utilization by Size and Mission



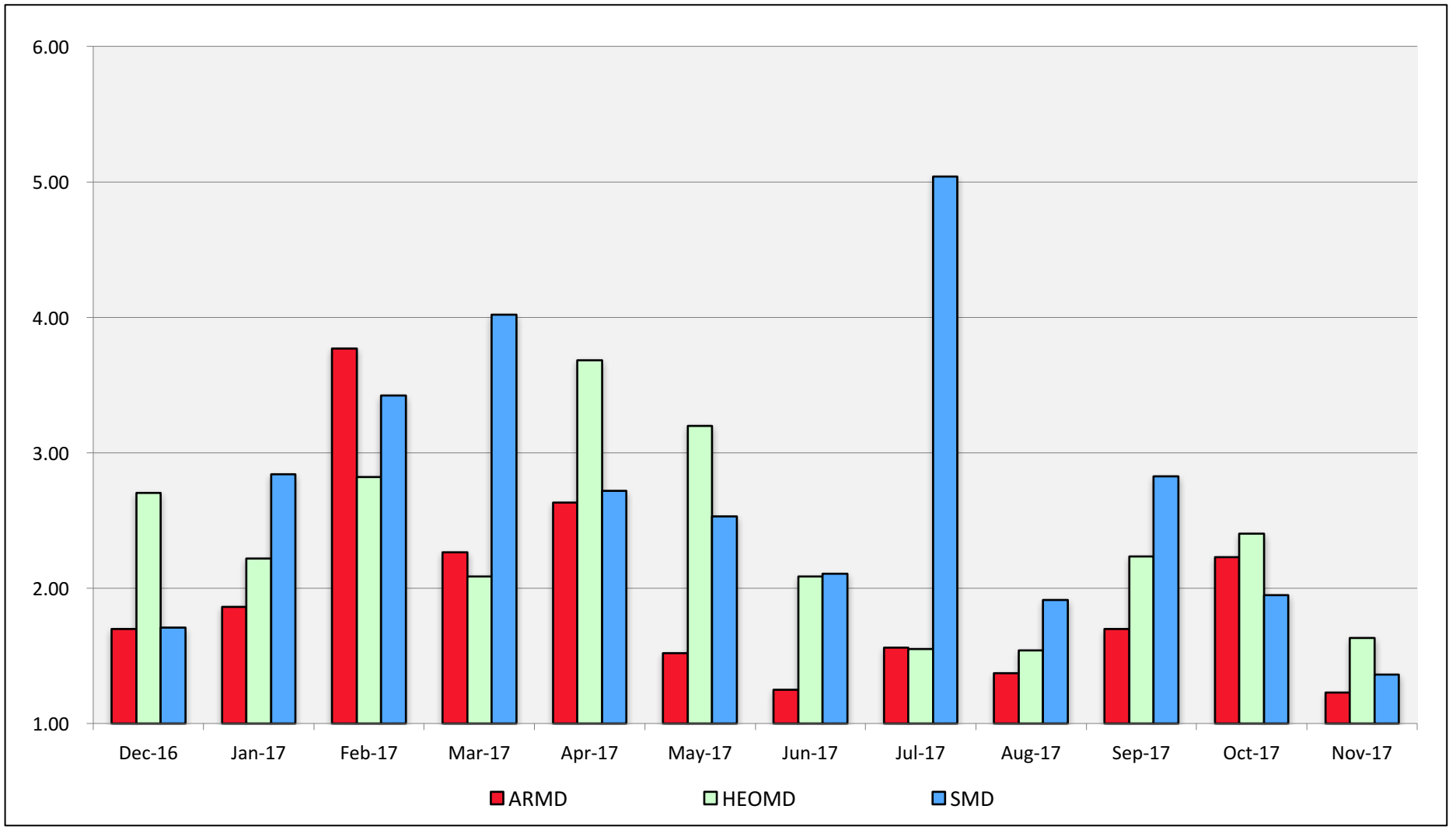
# Pleiades:
# Monthly Utilization by Size and Length



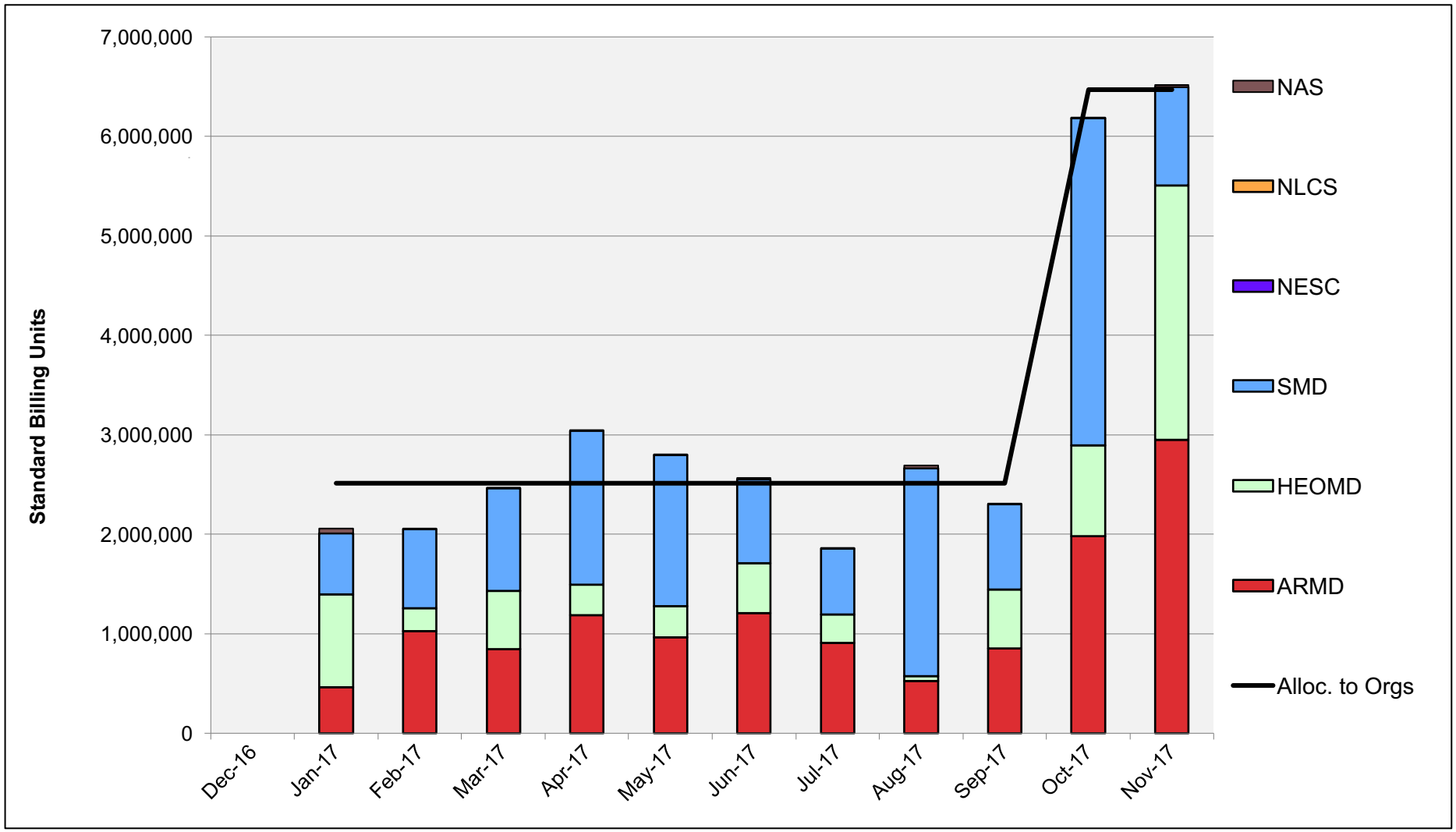
# Pleiades:
# Average Time to Clear All Jobs



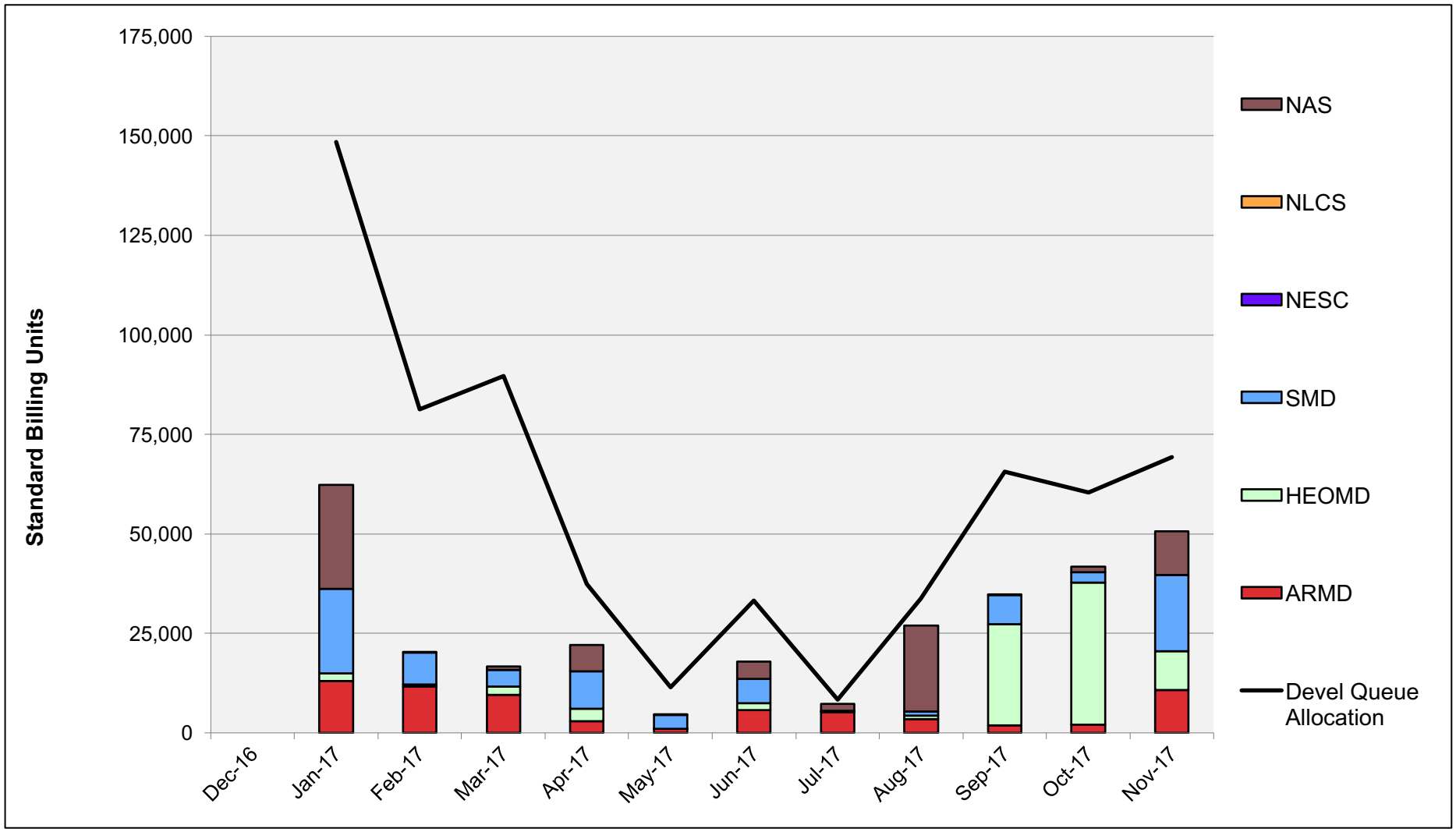
# Pleiades:
# Average Expansion Factor



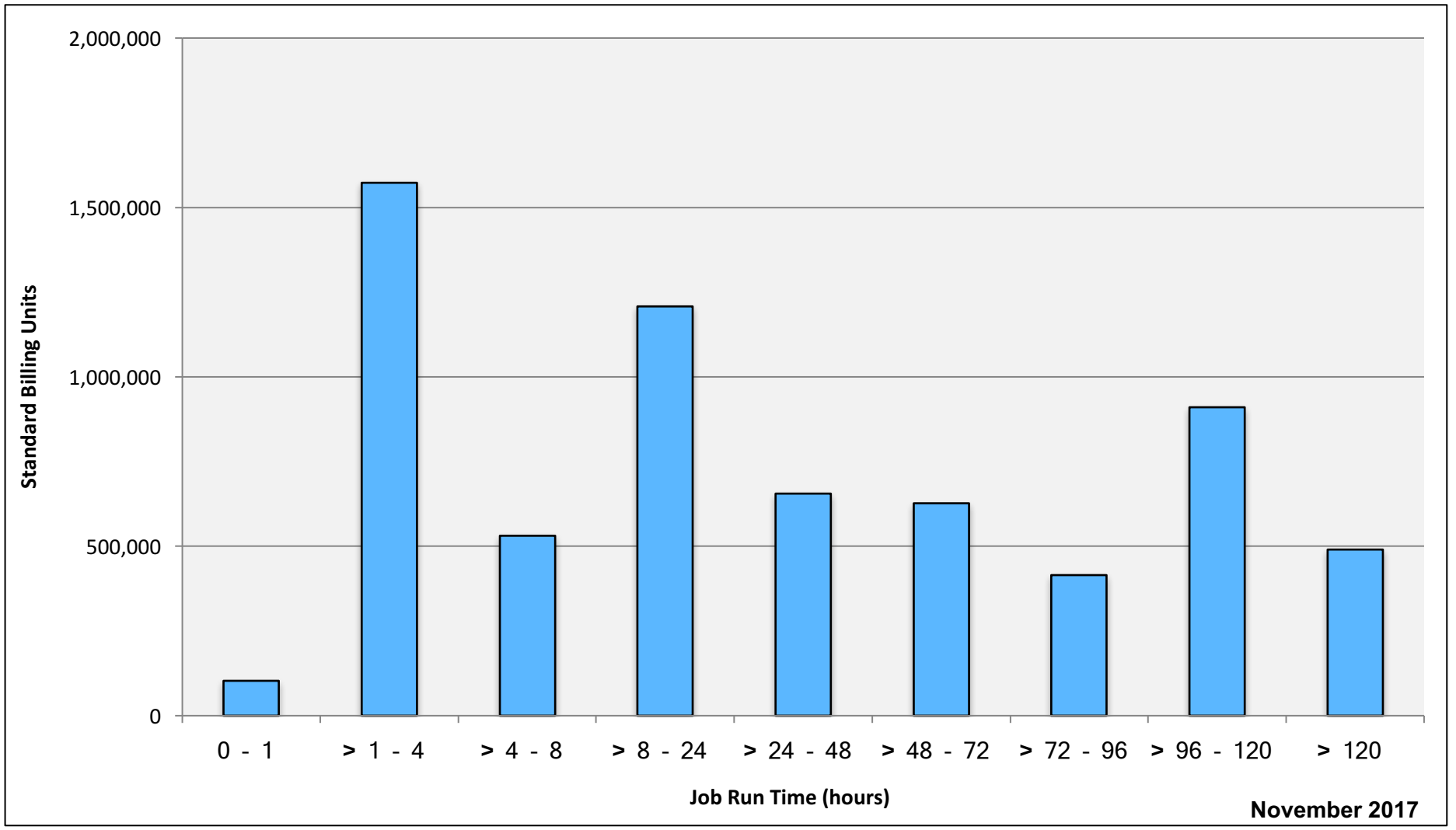
# Electra:
# SBUs Reported, Normalized to 30-Day Month



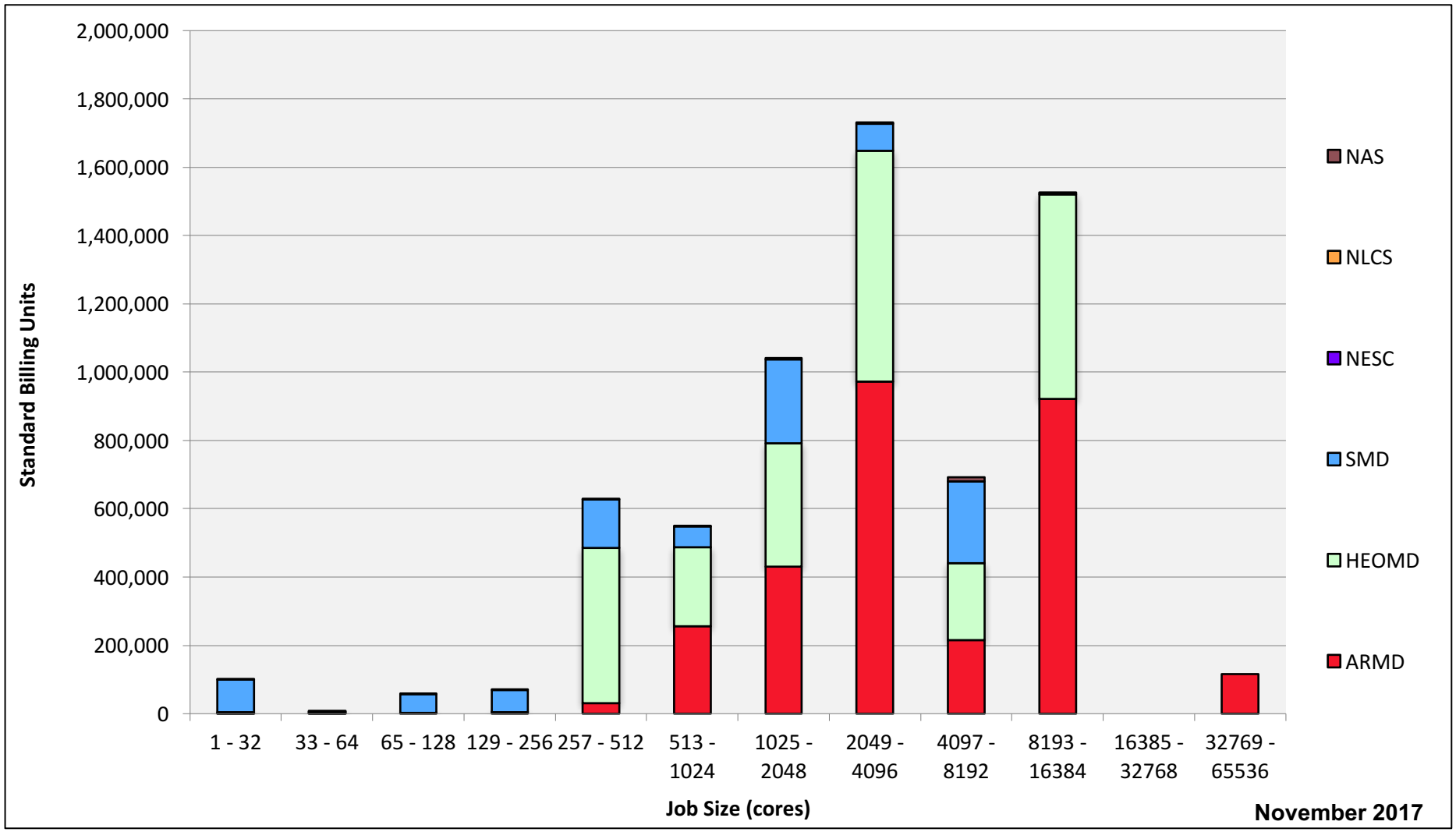
# Electra:
# Devel Queue Utilization



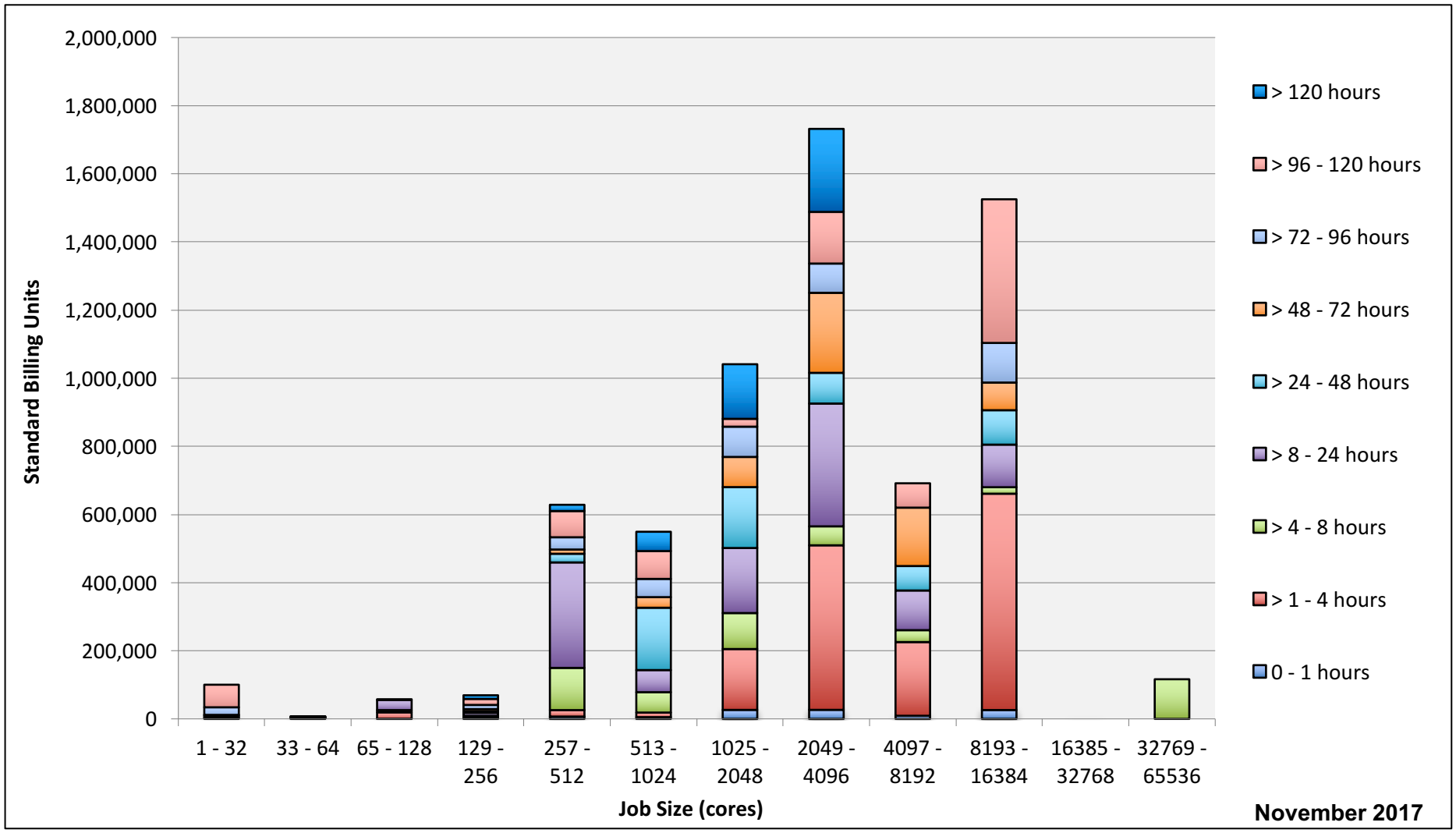
# Electra:
# Monthly Utilization by Job Length



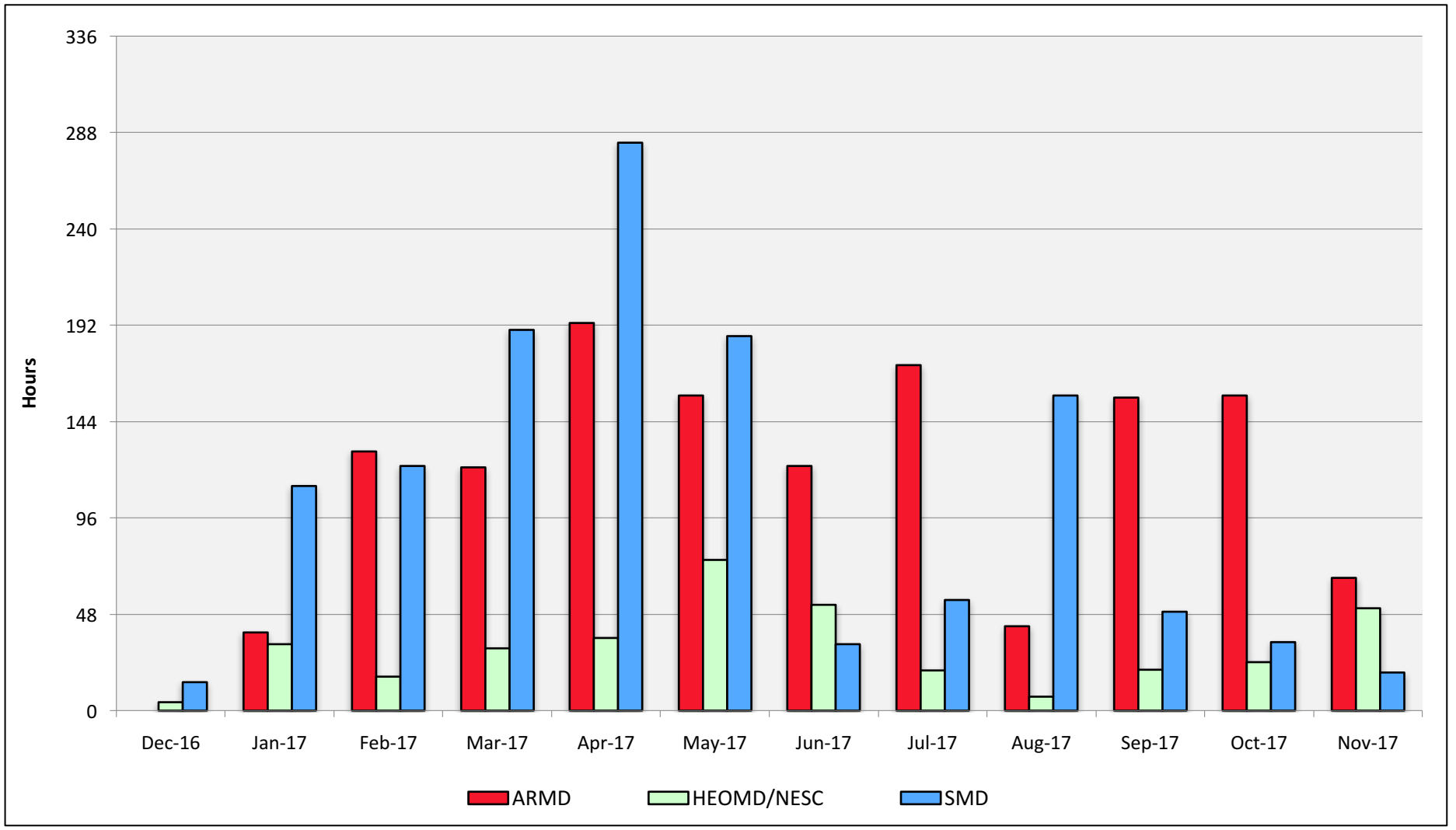
# Electra:
# Monthly Utilization by Size and Mission



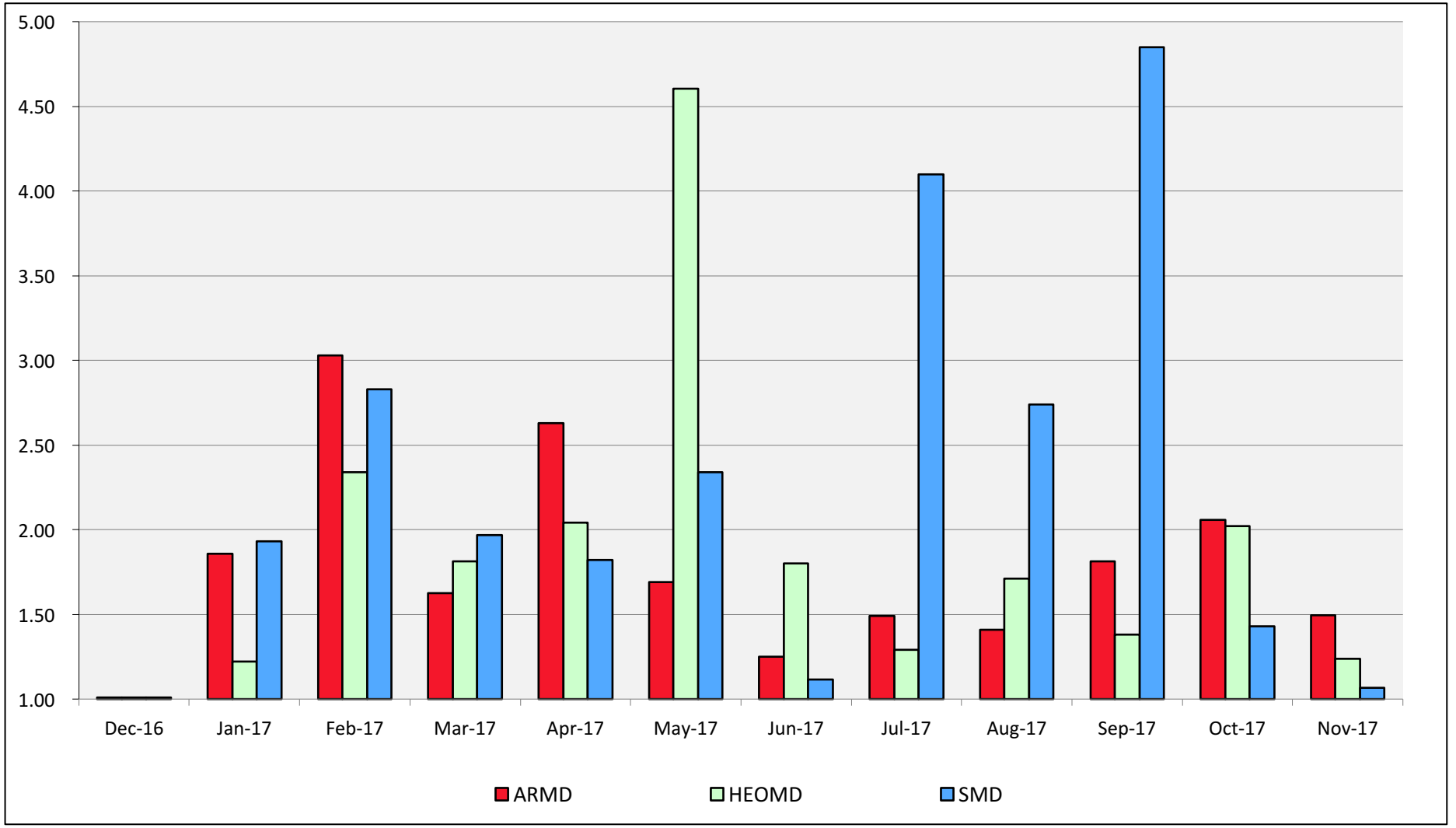
# Electra:
# Monthly Utilization by Size and Length



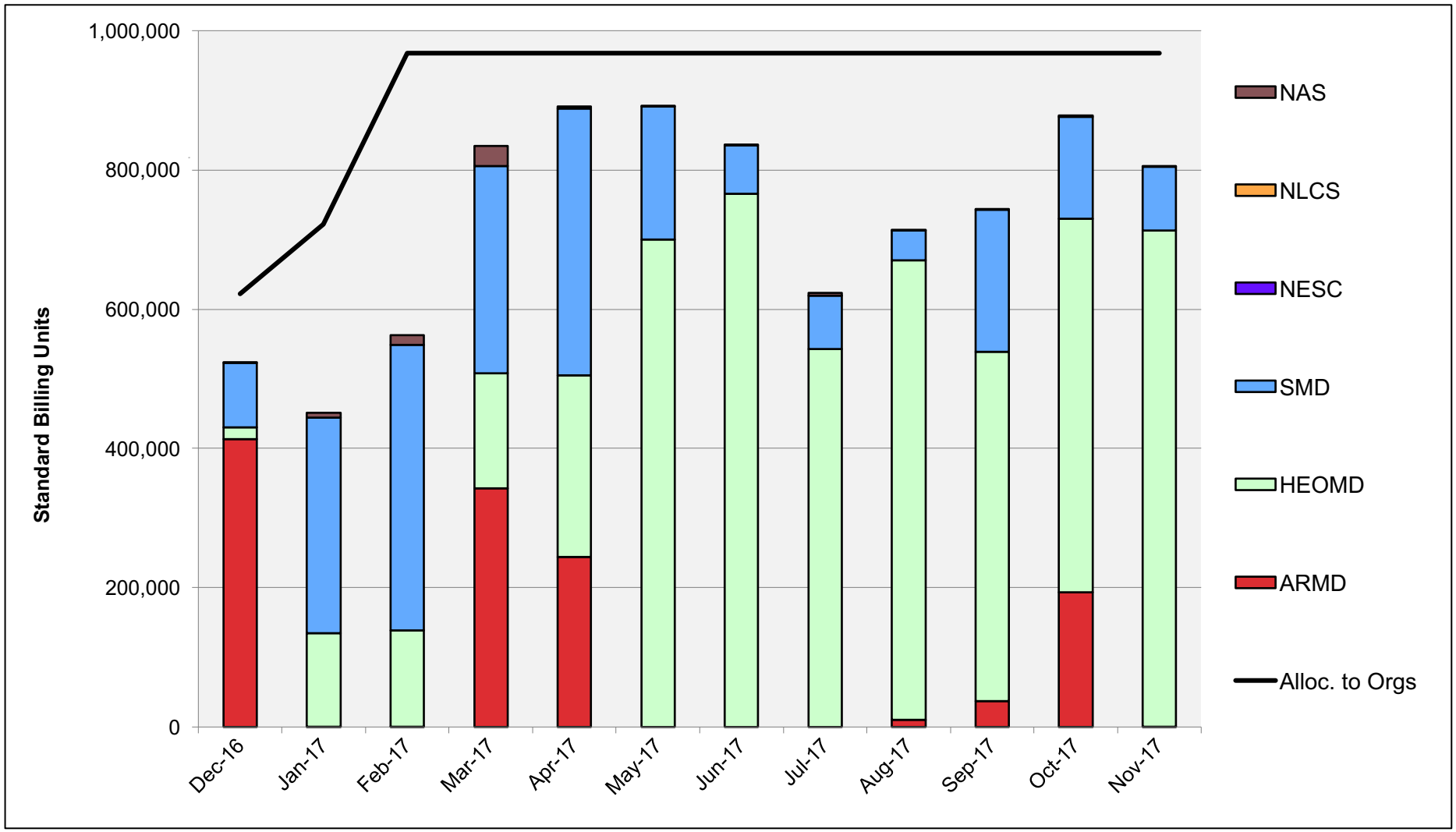
# Electra:
# Average Time to Clear All Jobs



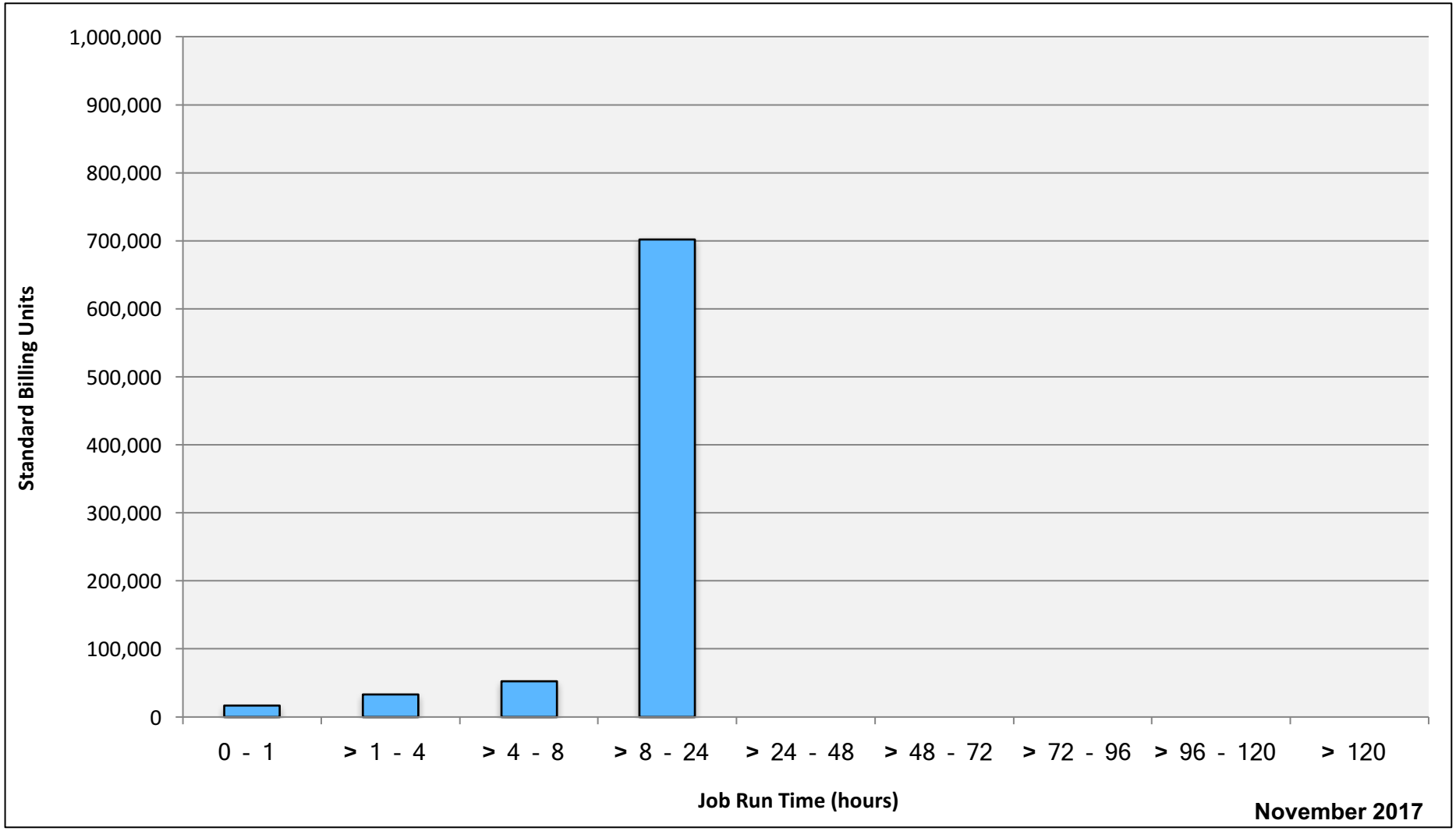
# Electra:
# Average Expansion Factor



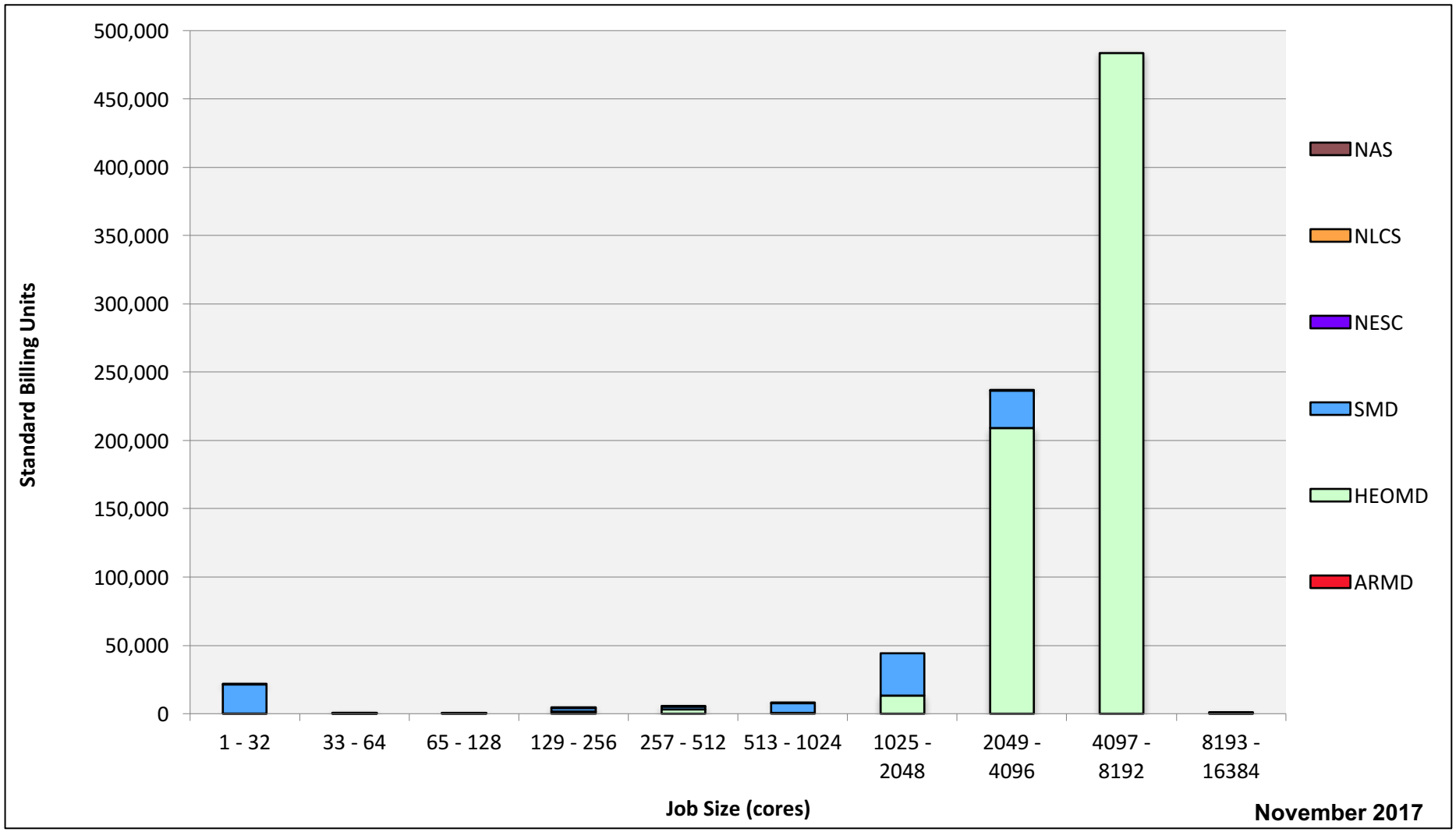
# Merope:
# SBUs Reported, Normalized to 30-Day Month



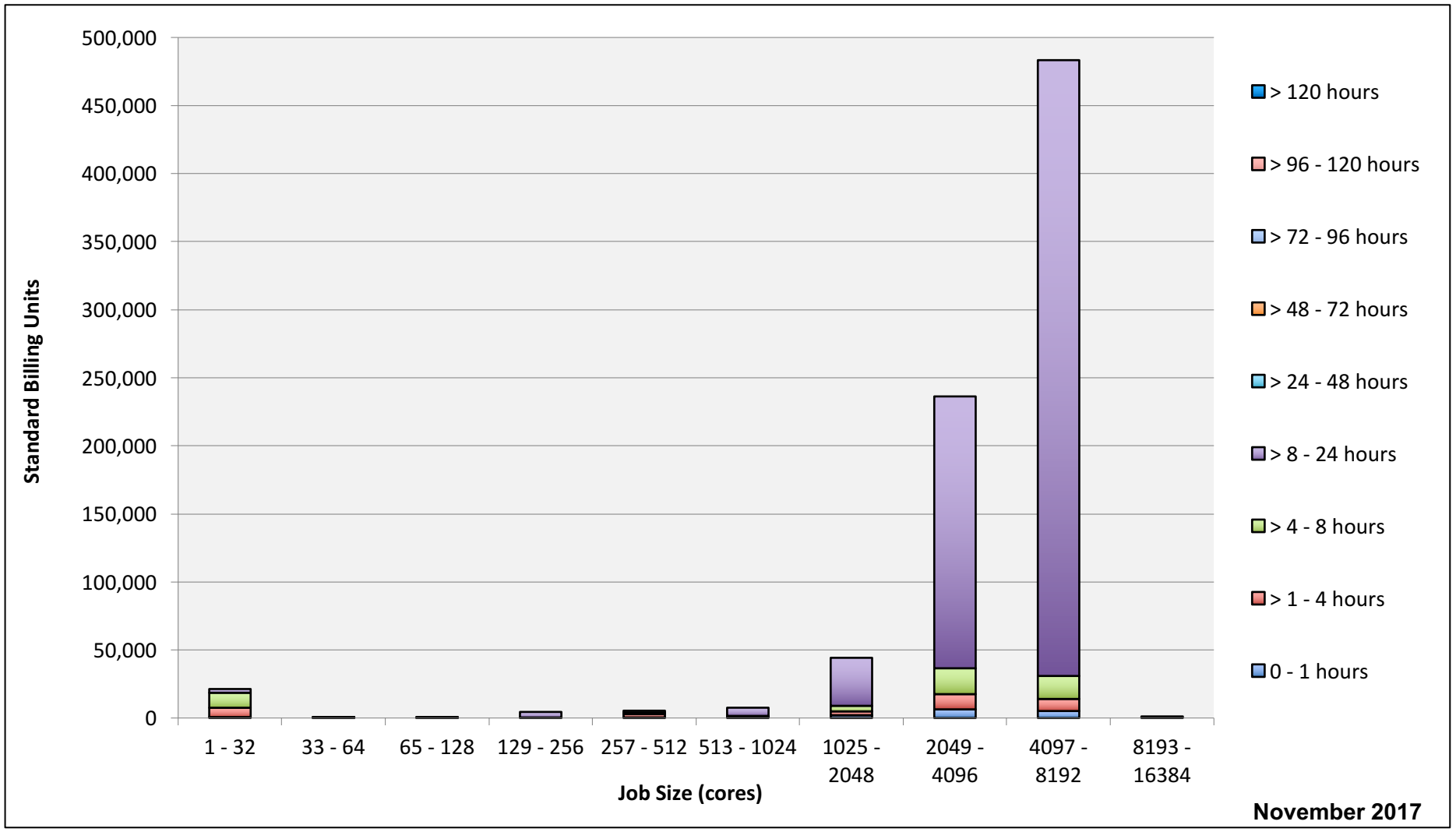
# Merope:
# Monthly Utilization by Job Length



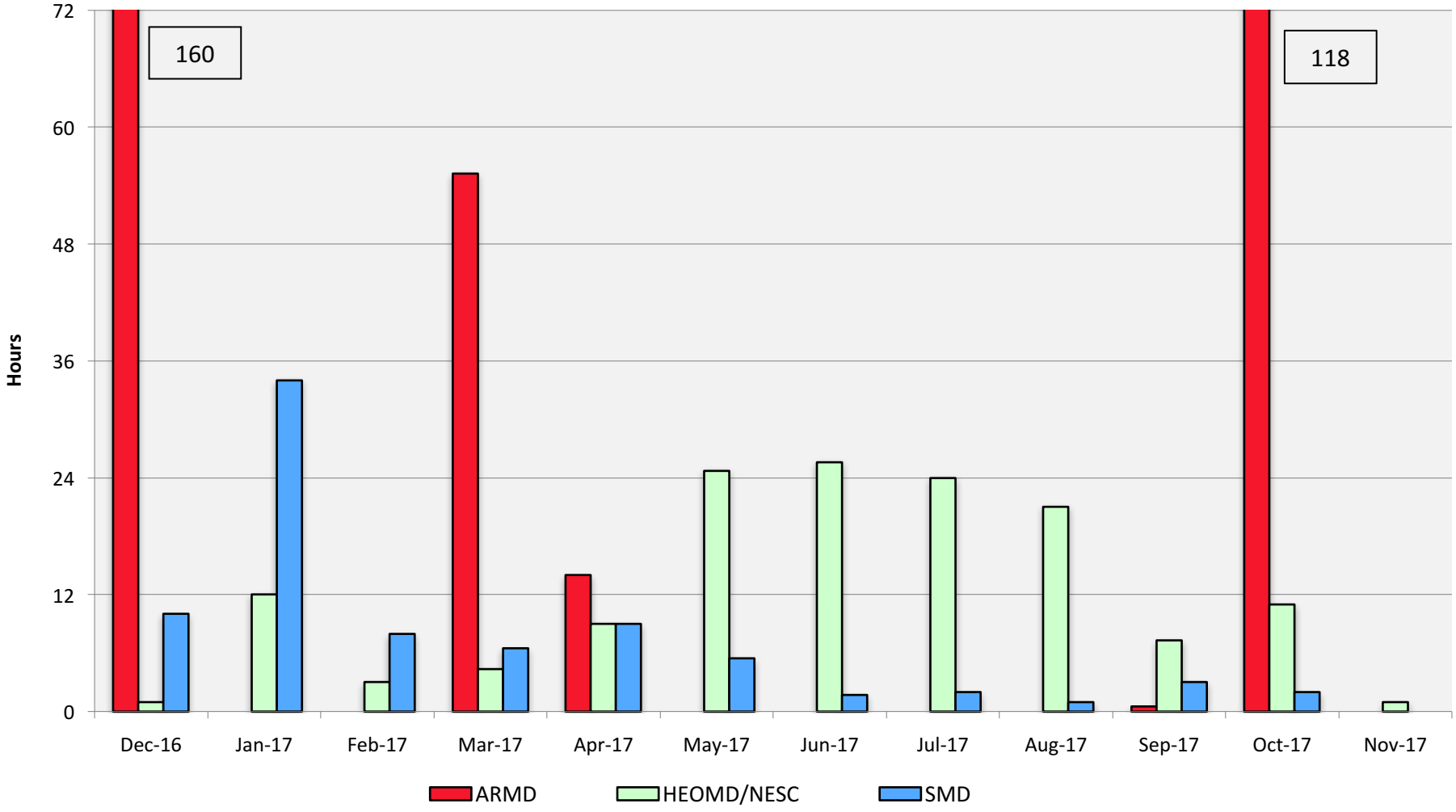
# Merope:
# Monthly Utilization by Size and Mission



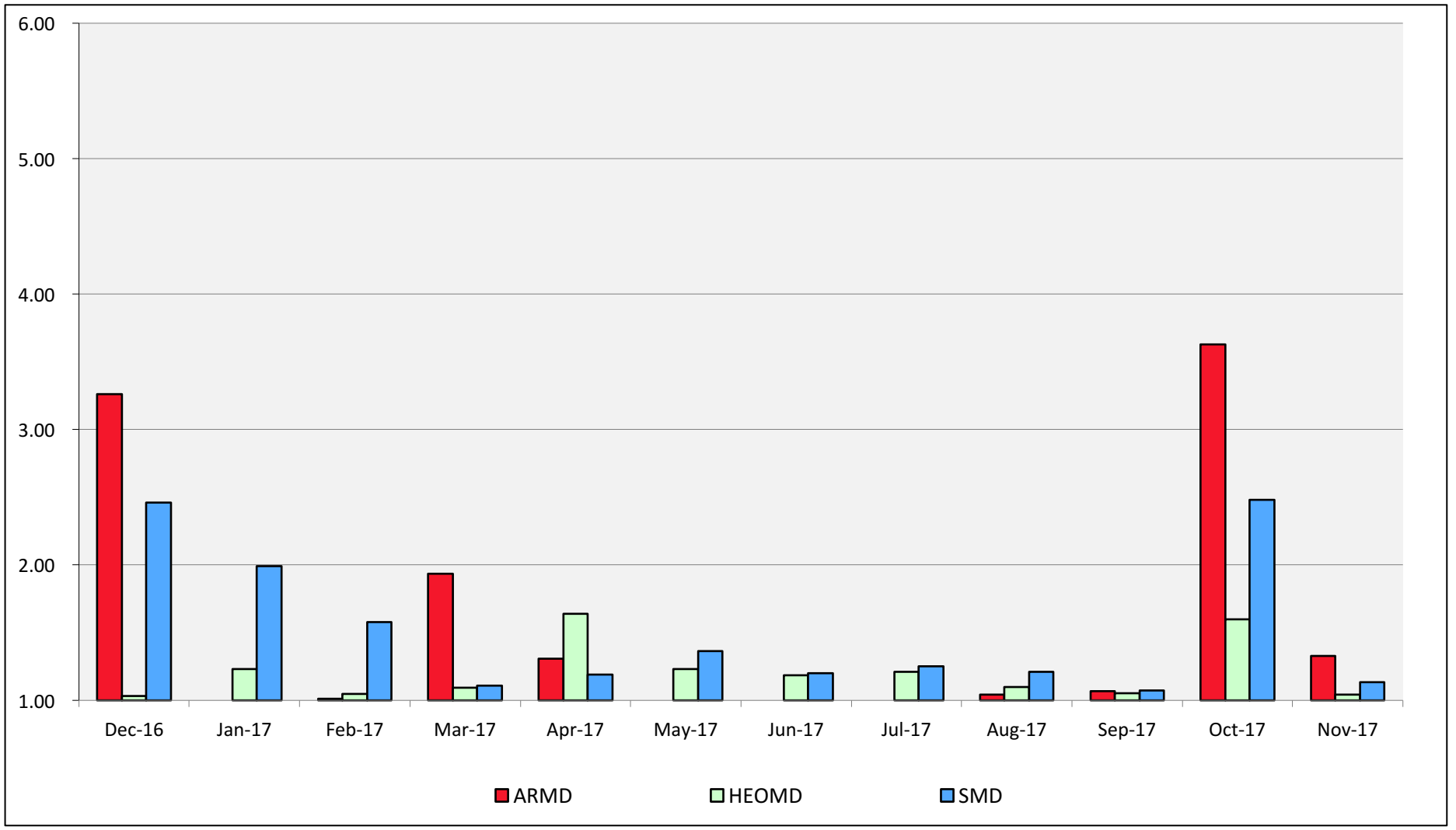
# Merope:
# Monthly Utilization by Size and Length



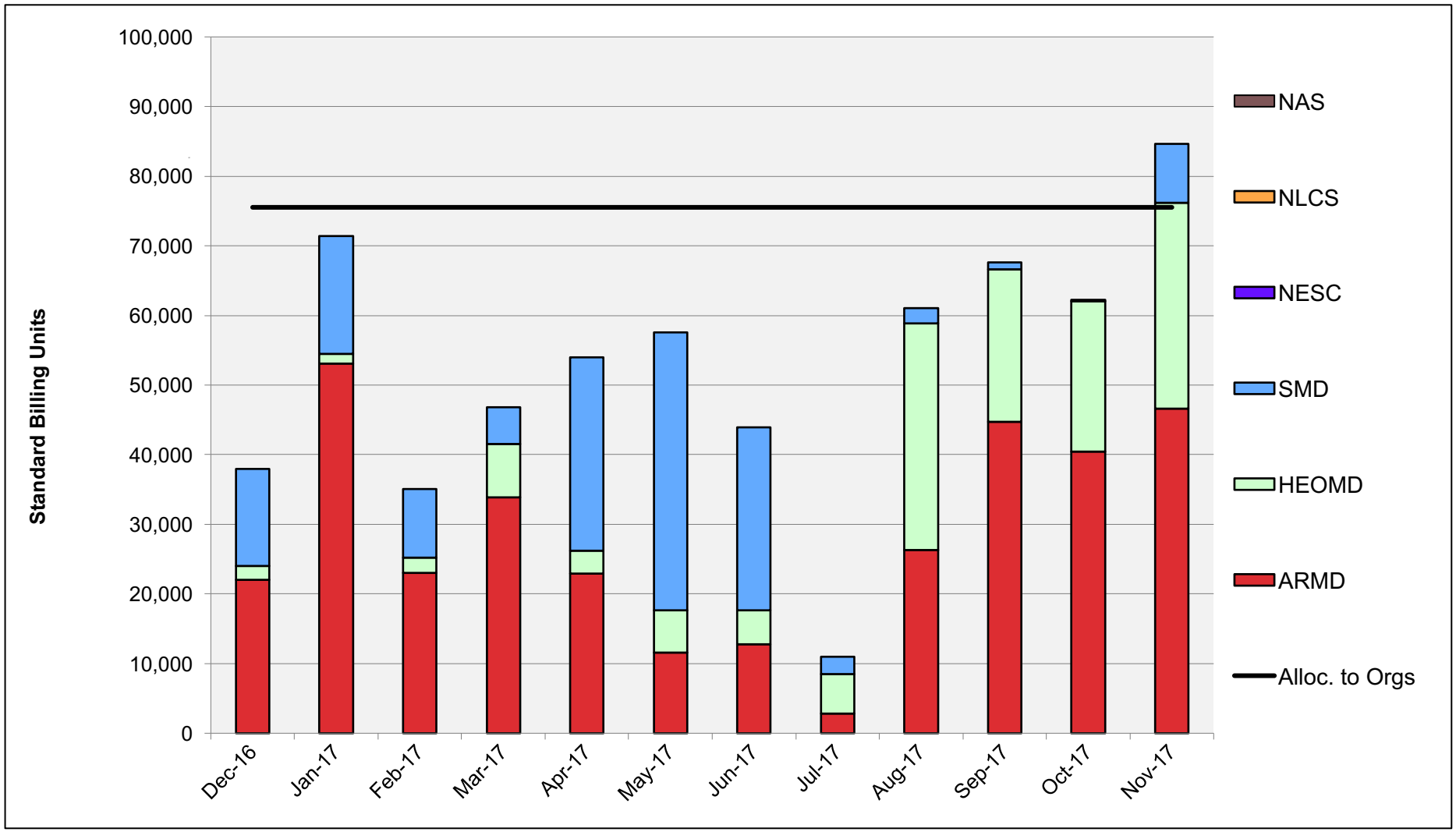
# Merope:
# Average Time to Clear All Jobs



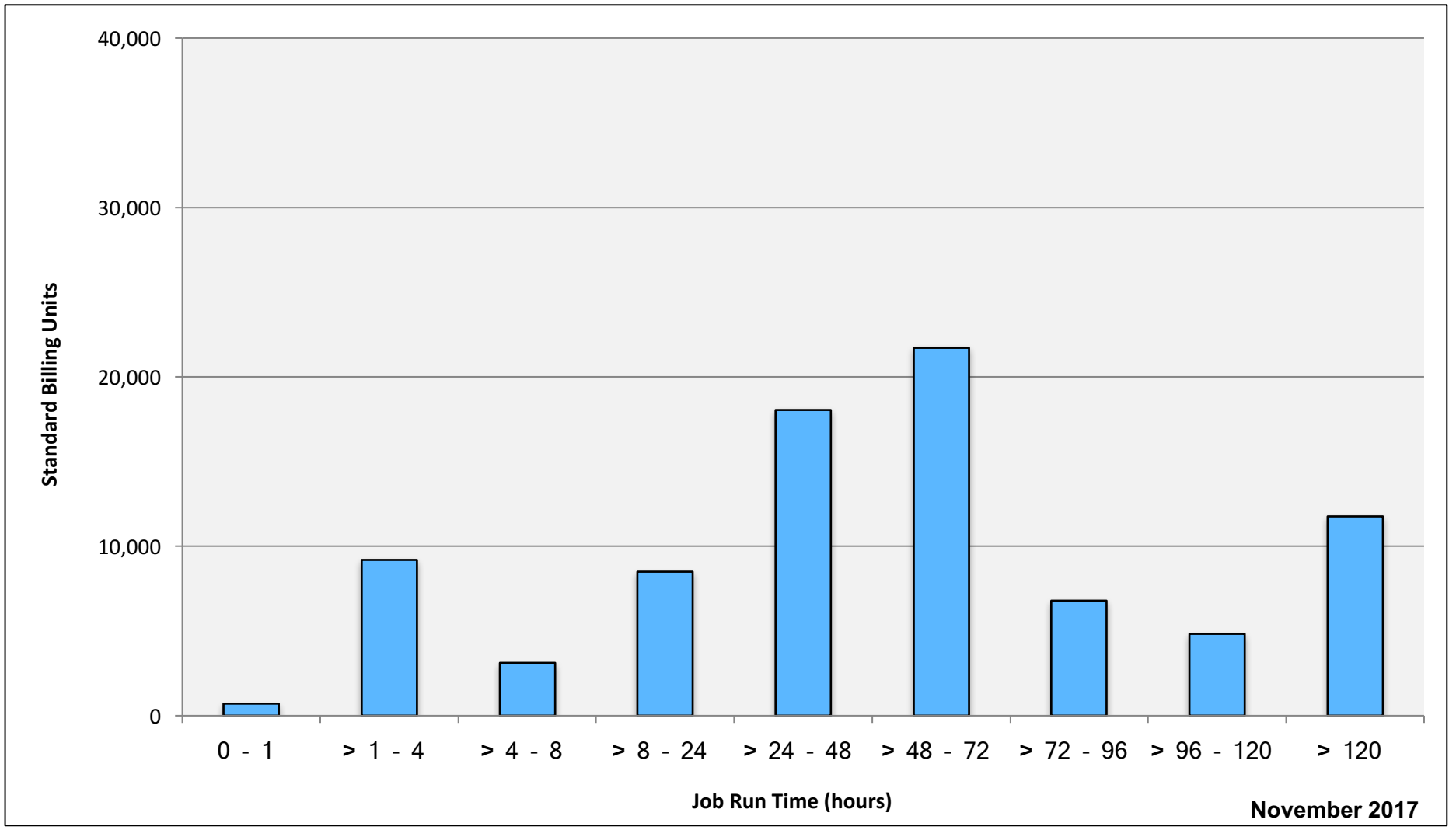
# Merope:
# Average Expansion Factor



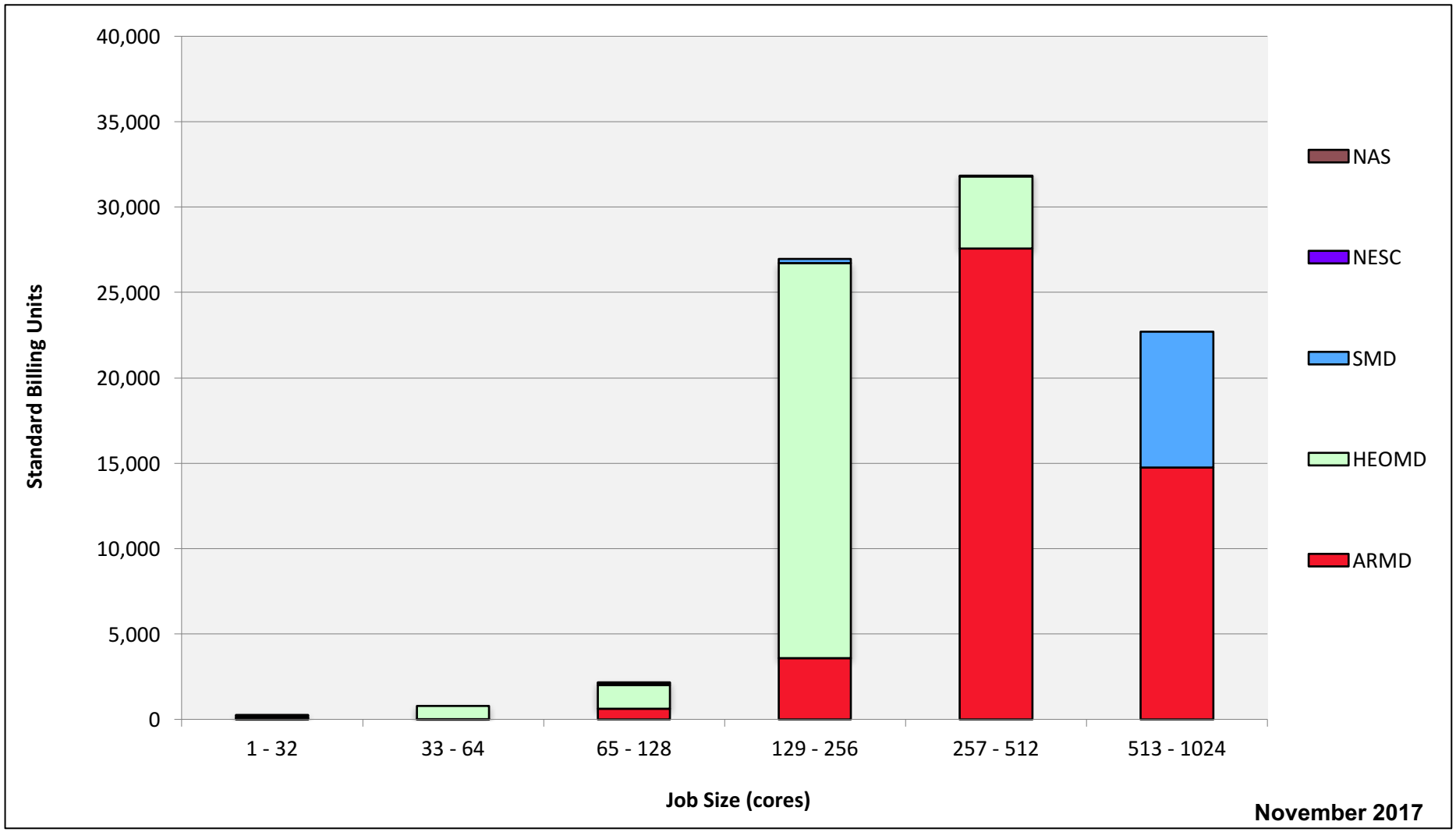
# Endeavour:
# SBUs Reported, Normalized to 30-Day Month



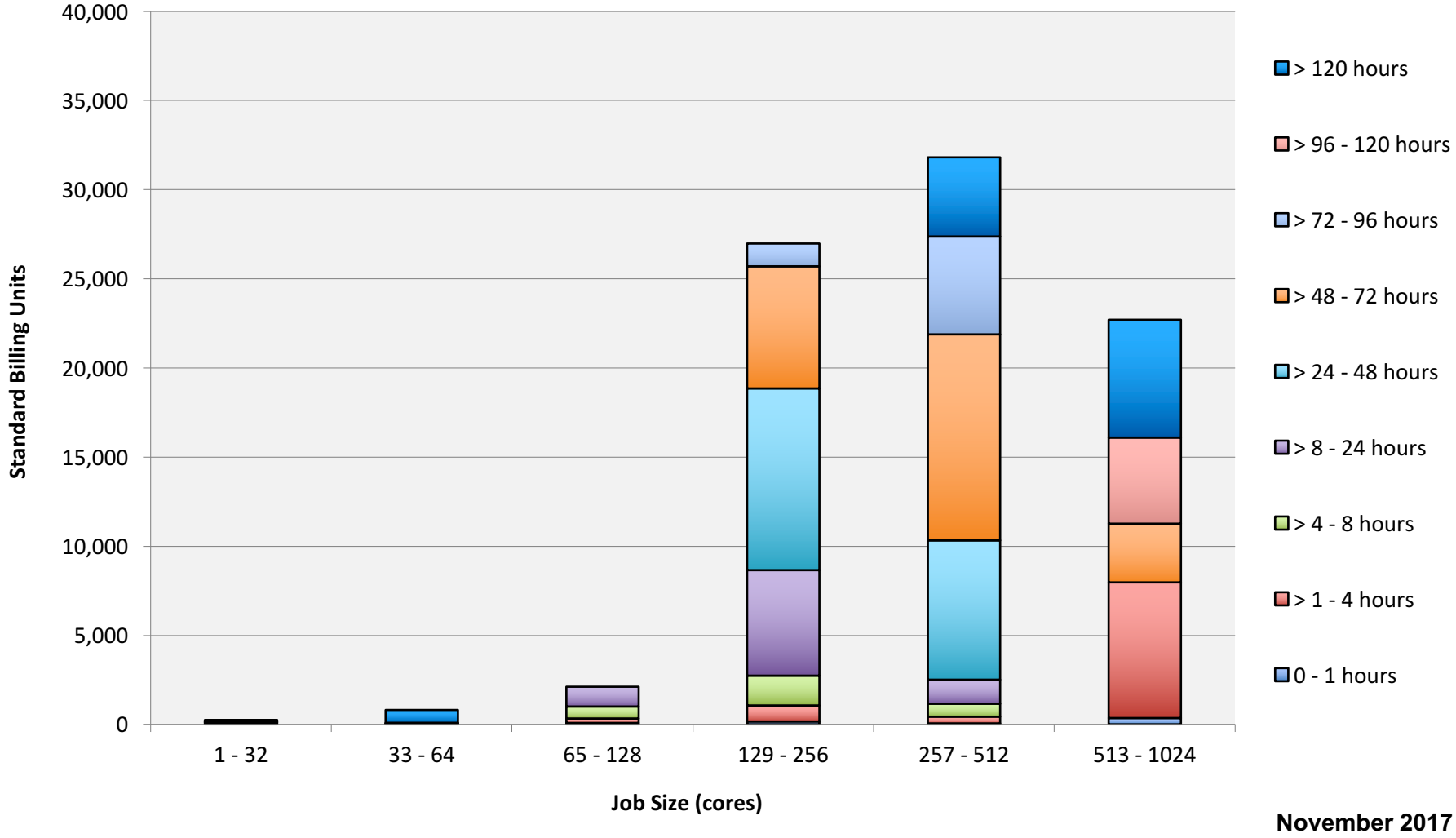
# Endeavour:
# Monthly Utilization by Job Length



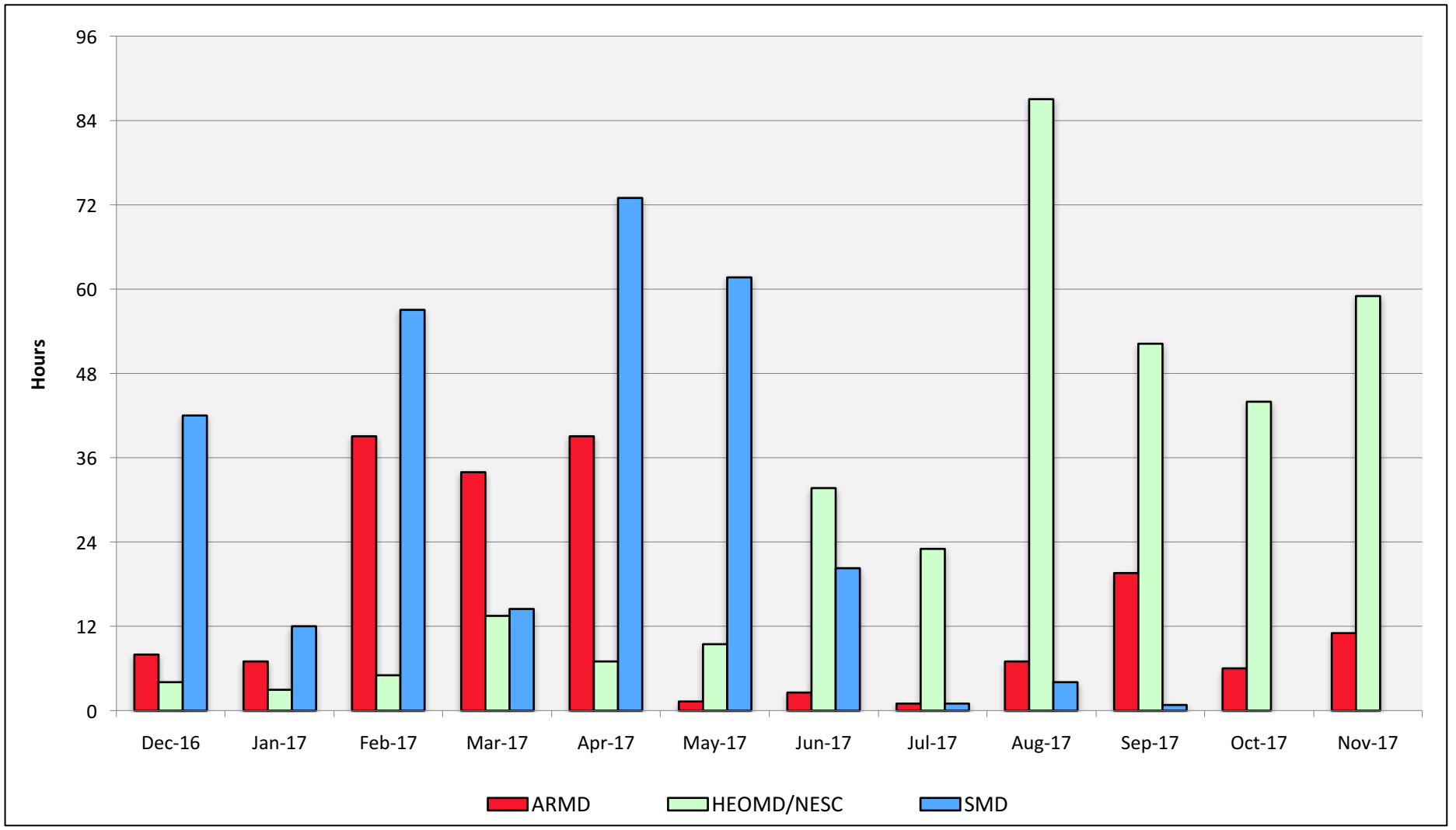
# Endeavour:
# Monthly Utilization by Size and Mission



# Endeavour:
# Monthly Utilization by Size and Length



# Endeavour:
# Average Time to Clear All Jobs



# Endeavour:
# Average Expansion Factor