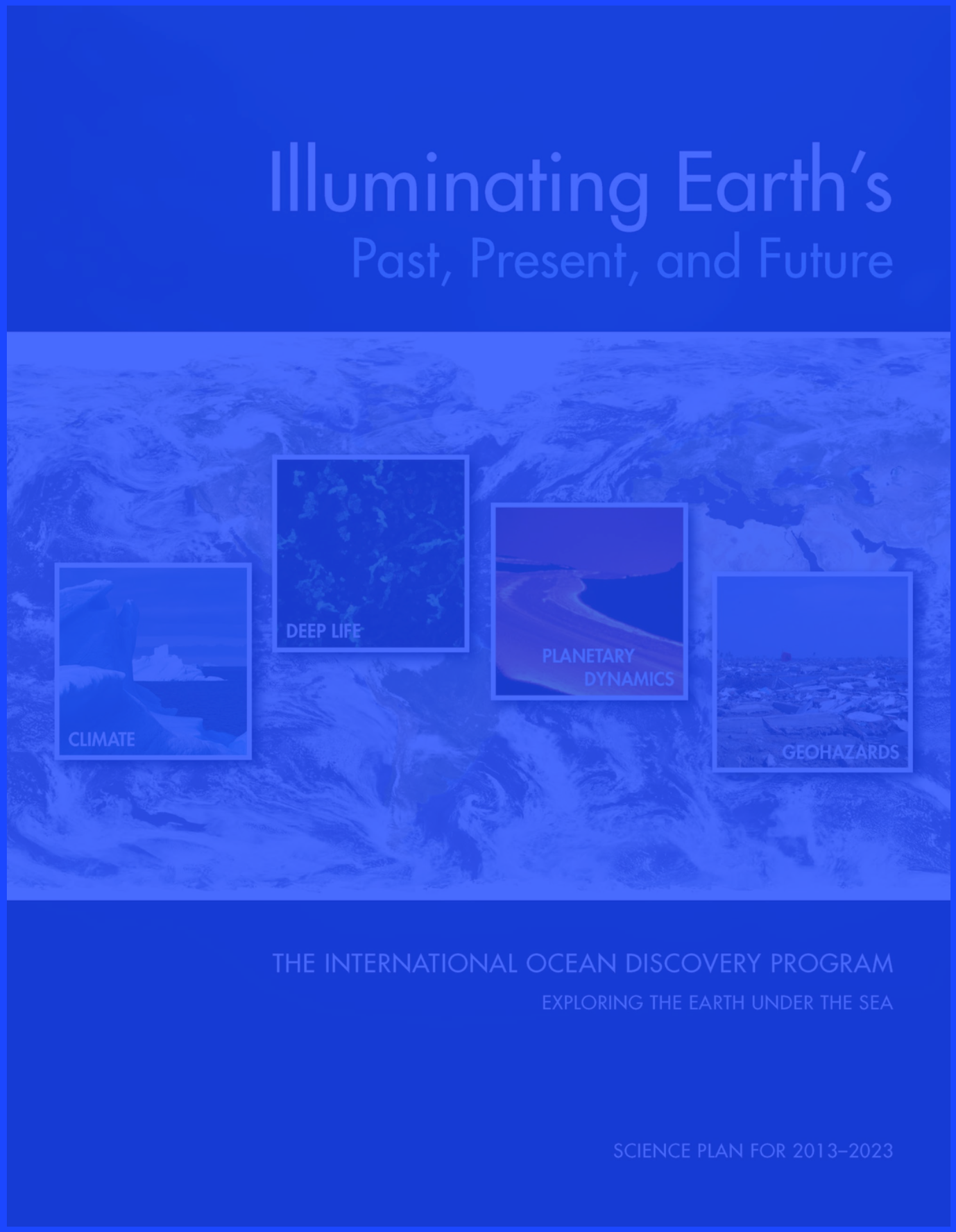
International Ocean Discovery Program:

Progress Toward Science Plan Fulfillment

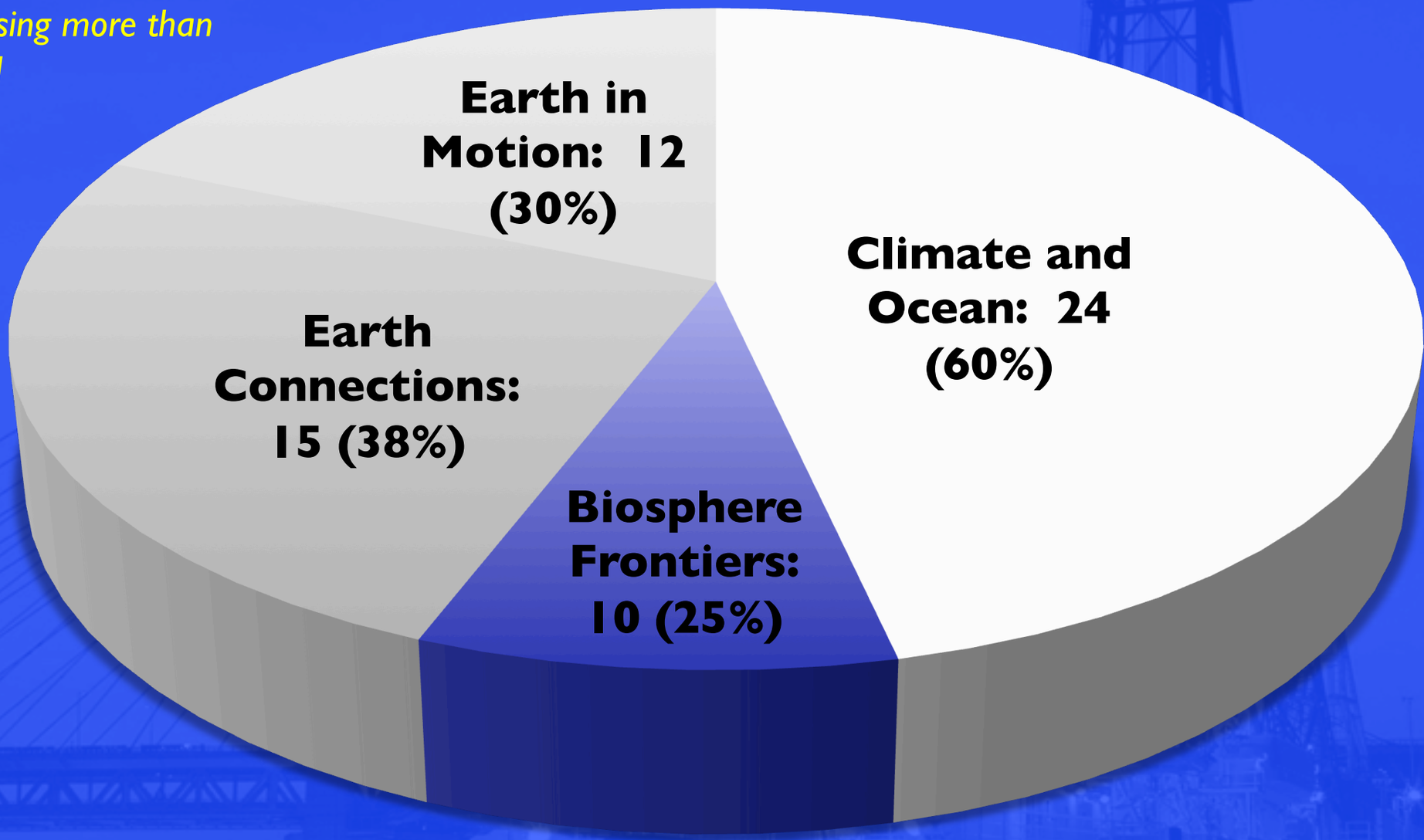
Prepared for the 2017 IODP Forum
Shanghai, China
James A. Austin, Jr., Chair

(with substantial input from Drs. Given and Yamamoto of the IODP Science Support Office



Completed/**Scheduled** Expeditions (40) by Theme

Note: Pie chart includes some expeditions addressing more than one theme, so total exceeds 100%.



Key for the following slides:

Top US priority challenge for JR IODP operations (as of 2012); ***to be revised by JRAW(?)***

JOIDES Resolution

Mission-Specific Platform

Chikyu (*** = PCT approved)

Note: updated after March-June 2017 EFB/CIB/JRFB/SEP decisions.

Climate and Ocean Change

Science Plan Challenge	Completed/**Scheduled** Expeditions (#) = submitted proposal(s)
1. Climate response to high atmospheric CO_2	361 S. African Climate (SAFARI) **369** Australia K Climate & Tectonics (760/897-APL) - 2017 371 Tasman Frontier Subduction Init. & Paleogene Climate **373** Antarctic Cenozoic Paleoclimate (813) – 2018 or later **377** Arctic Ocean Paleocean. (708) - 2018 **378** South Pacific Paleogene Climate (567) - 2018 **382** Iceberg Alley Paleocean. & S. Falkland Slope Drift (902/846-APL2) – 2019
2. Ice sheet and sea level response to warming climate	359 Maldives Monsoon & Sea Level **373** Antarctic Cenozoic Paleoclimate (813) – 2018 or later **374** Ross Sea WAIS History (751) - 2018 **377** Arctic Ocean Paleocean. (708) - 2018 **379** Amundsen Sea WAIS History (839) - 2019 **383** Dynamics of Pac.-Ant. Circumpolar Current (912) - 2019

Climate and Ocean Change

Science Plan Challenge	Completed/**Scheduled** Expeditions
3. Control of regional precipitation patterns	353 Indian Monsoon Rainfall 354 Bengal Fan 355 Arabian Sea Monsoon - CPP 356 Indonesian Throughflow 359 Maldives Monsoon & Sea Level 361 S. African Climate (SAFARI) 363 Western Pacific Warm Pool
4. Ocean response to chemical perturbation	364 Chicxulub Impact Crater **369** Australia K Climate & Tectonics (760/897-APL) - 2017 **374** Ross Sea WAIS History (751) - 2018 **378** South Pacific Paleogene Climate (567) - 2018

Biosphere Frontiers

Science Plan Challenge	Completed/**Scheduled** Expeditions
5. Origin, composition, and global significance of sub-seafloor biosphere	(347 Baltic Sea) 357 Atlantis Massif 366 Mariana Convergent Margin **374** Ross Sea WAIS History (751) - 2018 **376** Brothers Arc Flux (818) - 2018 **385** Guaymas Basin (833) - 2019
6. Limits of sub-seafloor life	370 Nankai Temp. Limit **374** Ross Sea WAIS History (751) - 2018 **376** Brothers Arc Flux (818) - 2018
7. Ecosystem sensitivity to environmental change	364 Chicxulub Impact Crater

Earth Connections

Science Plan Challenge	Completed/**Scheduled** Expeditions
8. Upper mantle composition/structure/ dynamics	(345 Hess Deep) 356 Indonesian Throughflow 357 Atlantis Massif 360 SW Indian Ridge Lower Crust/Moho
9. Seafloor spreading and ocean crustal architecture	(345 Hess Deep) 349 South China Sea Tectonics 367/368 South China Sea Rifted Margin **369** Australia K Climate & Tectonics (760/897-APL) – 2017 **381** Corinth Active Rift Dev. (879) – late 2017 **384** Panama Basin Crustal Arch. (504B) & Eng. (769-APL2) - 2019
10. Chemical exchange between oceanic crust and seawater	357 Atlantis Massif **376** Brothers Arc Flux (818) - 2018
11. Subduction, volatile cycling, and formation of continental crust	350 Izu Bonin Mariana: Rear Arc 351 Izu Bonin Mariana: Arc Origins 352 Izu Bonin Mariana: Forearc 371 Tasman Frontier Subduction Init. & Paleogene Climate

Earth in Motion

Science Plan Challenge	Completed/**Scheduled** Expeditions
12. Control of earthquakes, landslides, tsunami	**358** NanTroSEIZE Riser Hole at C0002 – 2018-2019 362 Sumatra Seismogenic Zone 365 NanTroSEIZE Megasplay LTBMS **372** Creeping Gas Hydrate Slides & Hikurangi LWD (841-APL) - 2017/18 **375** Hikurangi Observatory (781A) – 2018 **380** NanTroSEIZE Frontal Thrust LTBMS – late 2017 **381** Corinth Active Rift Dev. (879) – late 2017
13. Storage/flow of sub-seafloor carbon	**372** Creeping Gas Hydrate Slides & Hikurangi LWD (841-APL) - 2017/18 **386** GoM hydrates (887-CPP2) - 2019
14. Fluids linking sub-seafloor tectonic, thermal and biogeochemical processes	357 Atlantis Massif 366 Mariana Convergent Margin **376** Brothers Arc Flux (818) - 2018

Full Proposals by Theme/Challenge

- Updated after March-June 2017 CIB/FB/SEP decisions
- Does not include pre-proposals (except as noted)

<u>Key:</u>

* = Holding Bin, after external review

** = undergoing external review (following June 2016 SEP)

( ) = done during Integrated Ocean Drilling Program

{ } = security issues

Top U.S. priority challenge for JR, as of 2012 (***JRAW update?***)

JOIDES Resolution

Mission-Specific Platform

Chikyu (*** = PCT approved)

Climate and Ocean Change

Challenge	At CIB/FBs	At SEP
1. Climate response to high atmospheric CO_2	771 Iberian Margin Paleoclimate {778 Tanzania Margin Paleoclimate Transect} 834 Agulhas-Transkei Transect 813 Central Antarctic Paleocean. (exp. 373) 871-CPP Lord Howe Rise*** 897-APL Southern Ocean K Anoxia	747 N. Atl. Paleogene Climate 831-APL Campbell Drift Climate* 848 Weddell Sea History 864 Eq. Atl. Gateway 874 Neogene Newf. Sed. Drifts 888 Aleutian Basin Formation 909 NW Greenland 914 Brazilian Eq. Margin Paleo.
2. Ice sheet and sea level response to warming climate	716 Hawaiian Drowned Reefs 730 Sabine Bank Sea Level 732 Antarctic Pen. Sed. Drifts 771 Iberian Margin Paleoclimate 777-APL3 Okinawa 813 Central Antarctic Paleocean. (exp. 373)	848 Weddell Sea History 863 MDP Integrated S. Ocean Lat. Transects 909 NW Greenland

Climate and Ocean Change

Challenge	At CIB/FBs	At SEP
3. Control of regional precipitation patterns	{549 Arabian Sea Monsoon} {595 Indus Fan/Murray Ridge} 618 East Asian Margin	819-APL2 Arabian Sea OMZ* 859 Amazon Margin Drilling
4. Ocean response to chemical perturbation		819-APL 2Arabian Sea OMZ* 888 Aleutian Basin Formation

Biosphere Frontiers

Challenge	At CIB/FBs	At SEP
5. Origin, composition, and global significance of sub-seafloor biosphere	633 Costa Rica Mud Mounds 830-APL Scott Plateau	853 South Atlantic Transect*
6. Limits of sub-seafloor life		
7. Ecosystem sensitivity to environmental change	{724 Gulf of Aden}	819-APL2 Arabian Sea OMZ* 853 South Atlantic Transect* 859 Amazon Margin

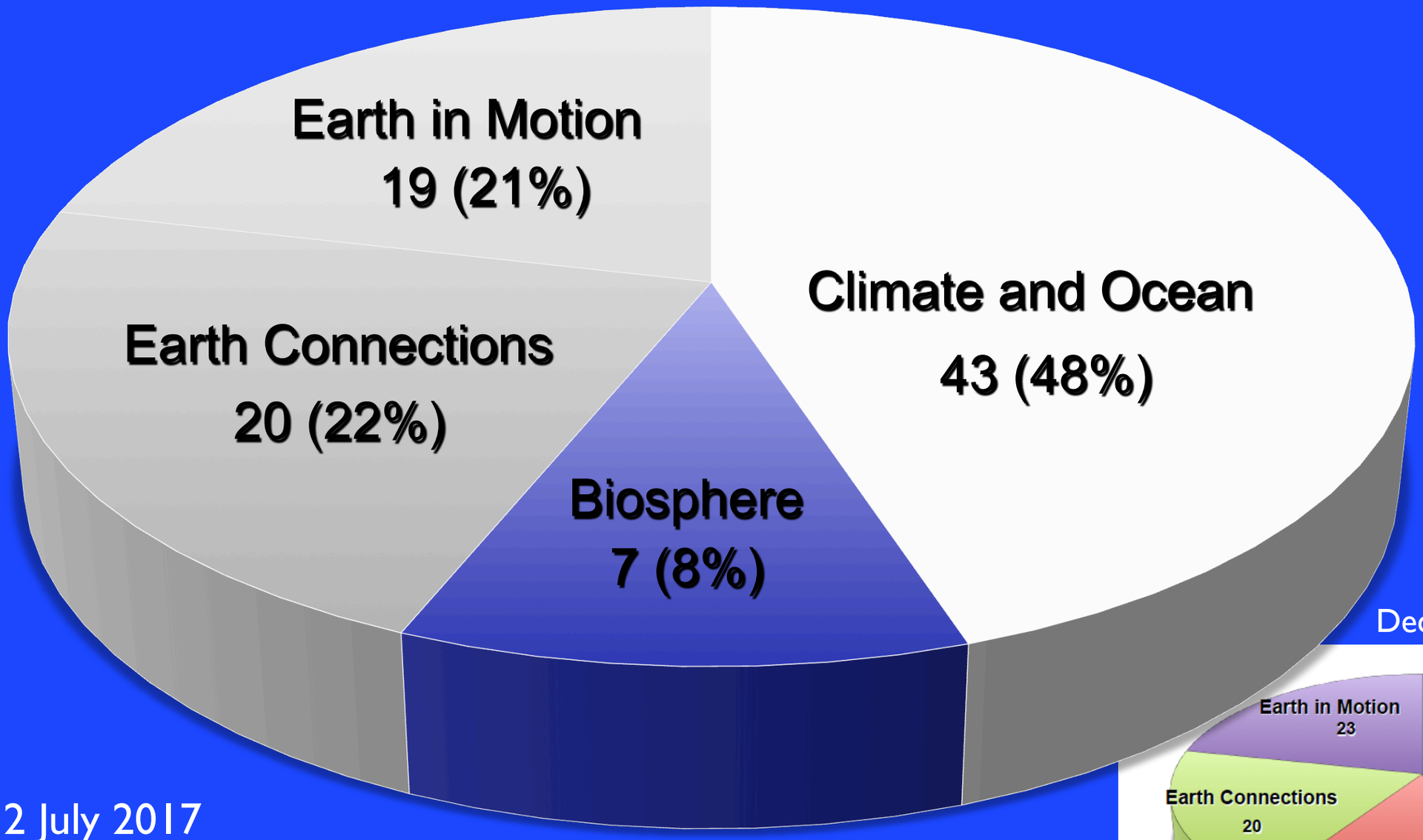
Earth Connections

Challenge	At CIB/FBs	At SEP
8. Upper mantle composition/ structure/ dynamics	522 Superfast Spreading Crust	805 Mohole to the Mantle 834 Agulhas-Transkei Transect 890 Walvis Ridge Hotspot 892 Reykjanes Mantle Convection
9. Seafloor spreading and ocean crustal architecture	522 Superfast Spreading Crust 769-APL2 Costa Rica Crustal Architecture (504B logs)	805 Mohole to the Mantle 853 South Atlantic Transect* 890 Walvis Ridge Hotspot
10. Chemical exchange between oceanic crust and seawater		853 South Atlantic Transect* 892 Reykjanes Mantle Convection
11. Subduction, volatile cycling, and formation of continental crust	698 IBM Middle Crust*** 781B Hikurangi Riser 908-APL Costa Rica Megathrust Fluid Pressure	888 Aleutian Basin Formation

Earth in Motion

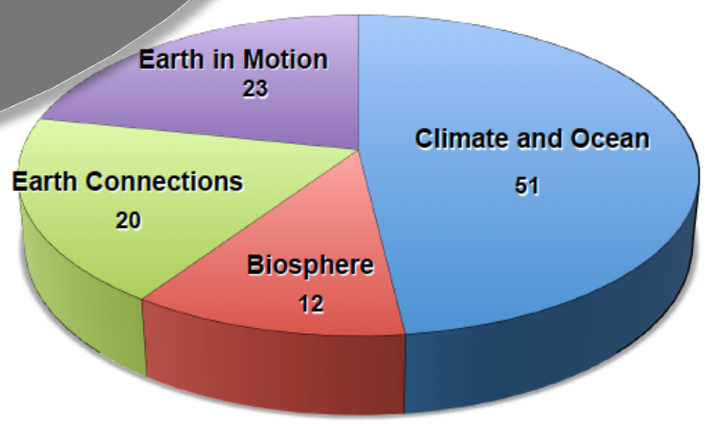
Challenge	At CIB/FBs	At SEP
12. Control of earthquakes, landslides, tsunami	NanTroSEIZE 3,4*** (603C,D) 537B CRISP B*** 781B Hikurangi Riser 835 JTRACK	770 Kanto Asperity* 796 NADIR: Nice ADP 811 Cape Fear Slope Stability 866 Japan Trench Paleoseis.
13. Storage/flow of sub-seafloor carbon	791-APL2 Cont. Margin Methane Cycling	811 Cape Fear Slope Stability 836-APL Cont. Margin Methane Cycling*
14. Fluids linking sub-seafloor tectonic, thermal and biogeochemical processes	633 Costa Rica Mud Mounds 637 New England Hydrogeology	

Active proposals: 89, by Science Plan themes

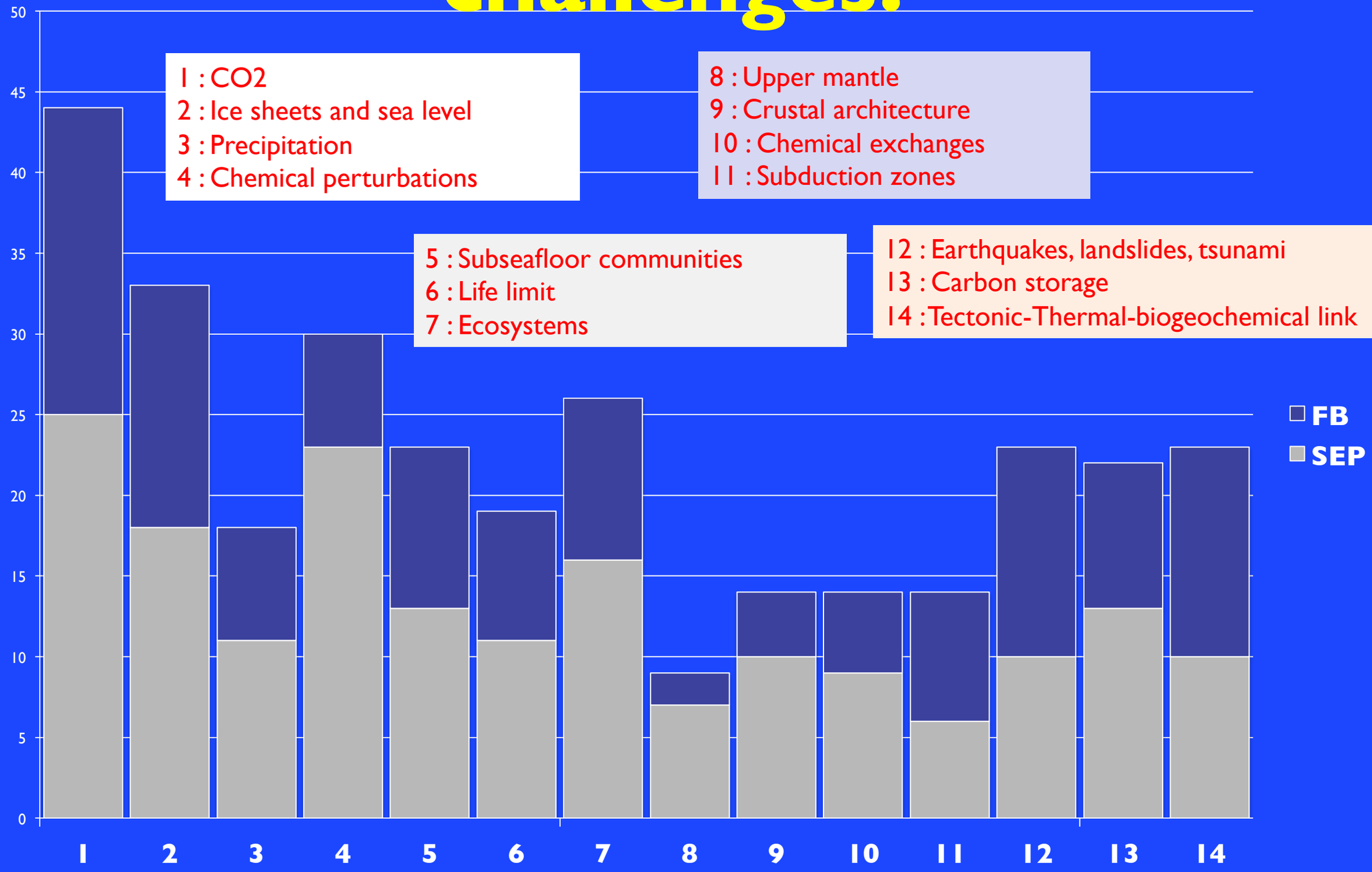


As of 12 July 2017

December 2013

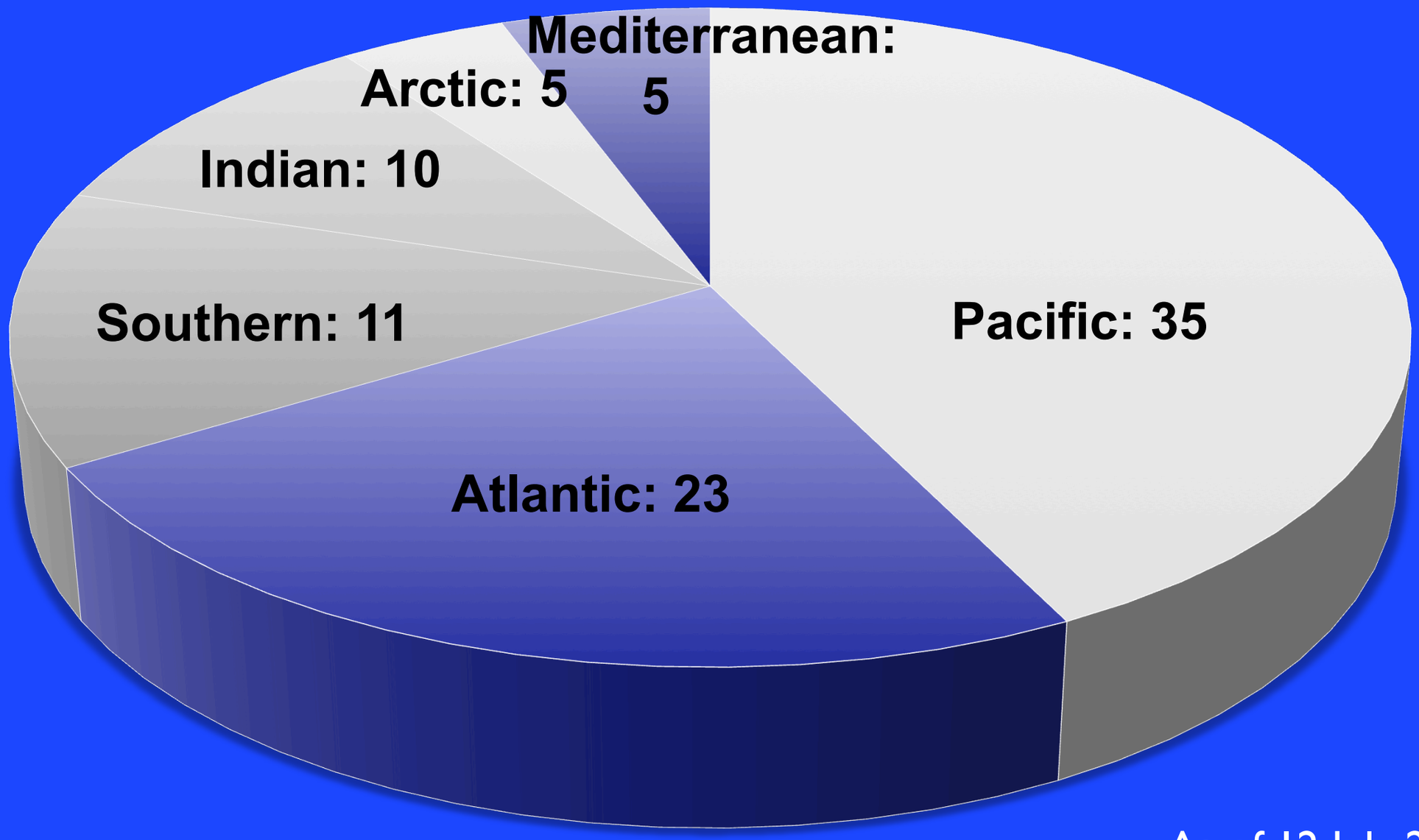


How many proposals address which challenges?



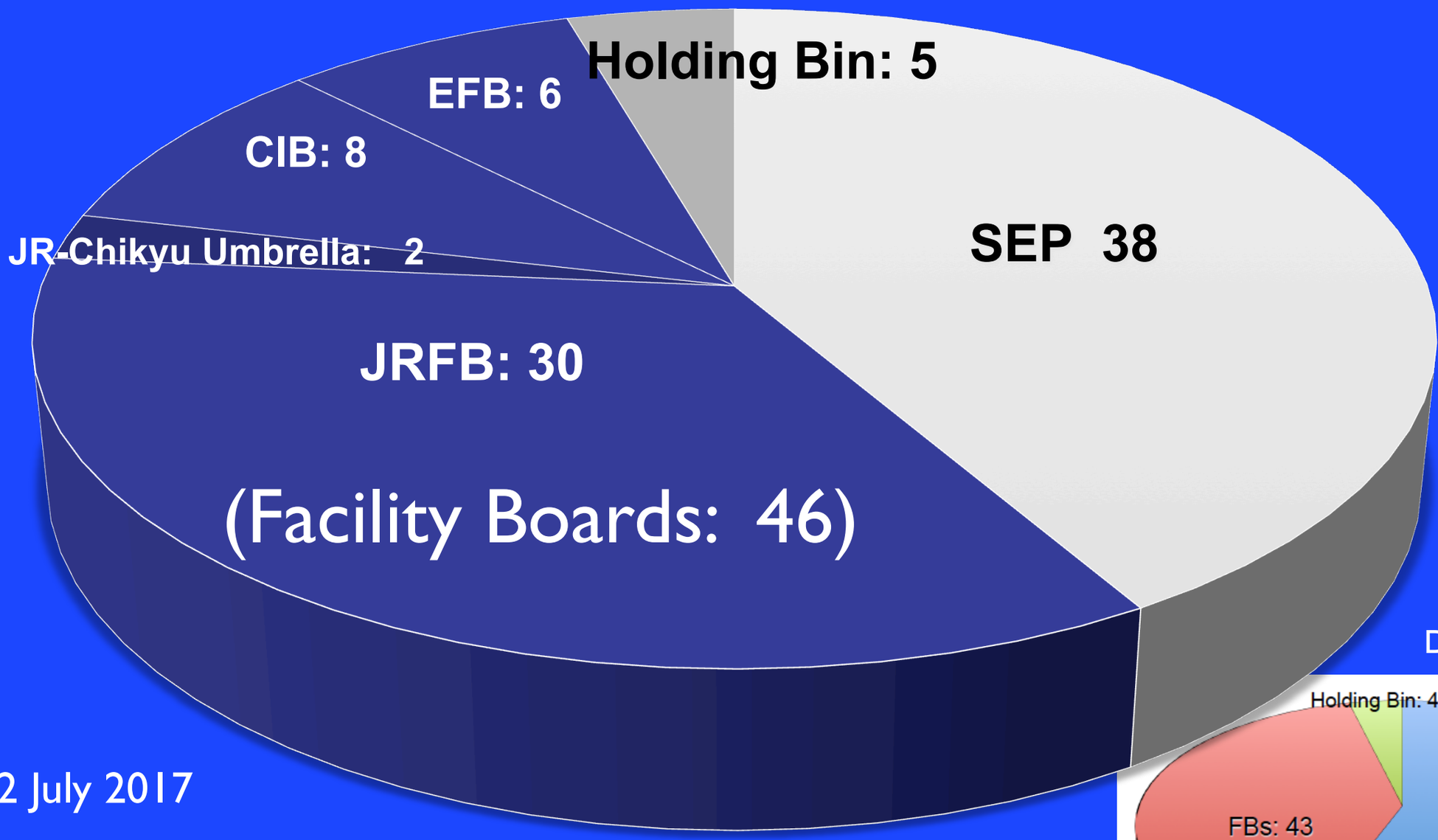
As of 12 July 2017

Active proposals: 89, by target ocean



As of 12 July 2017

Active proposal status: 89, by review stage



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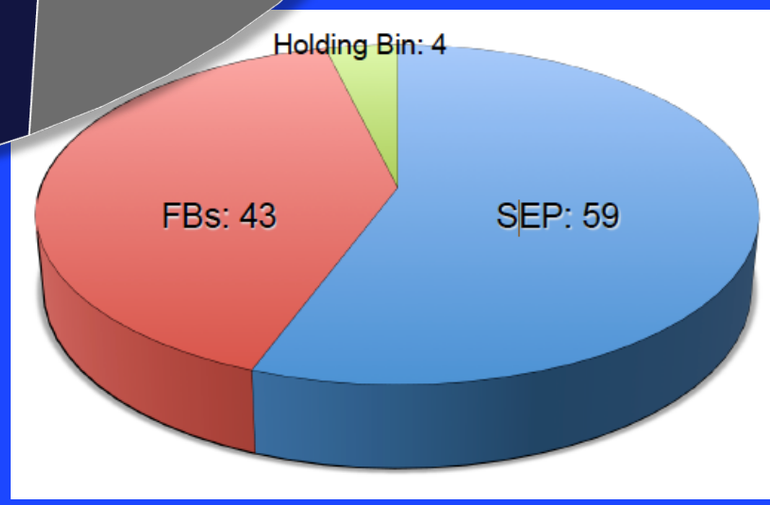
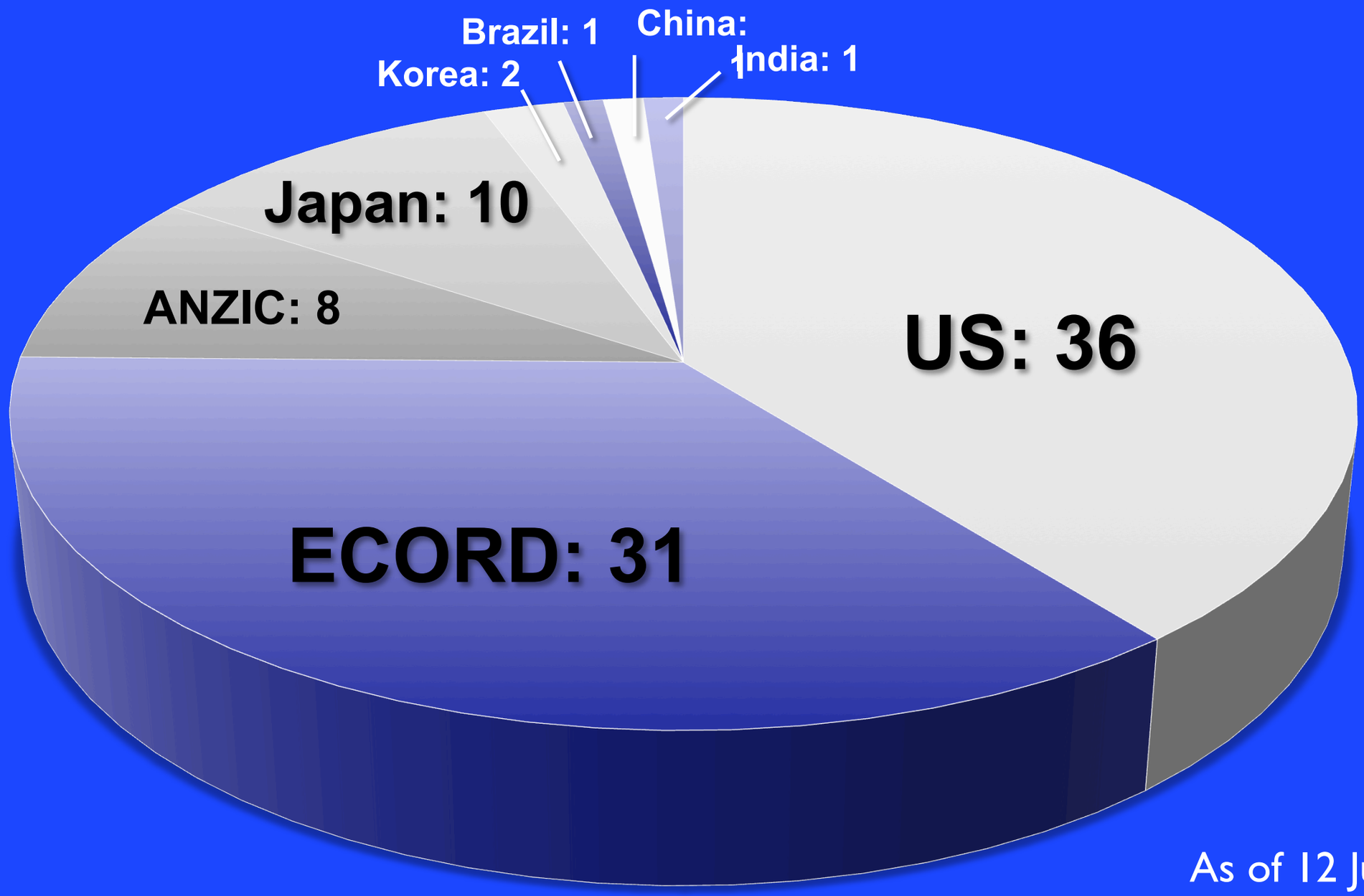
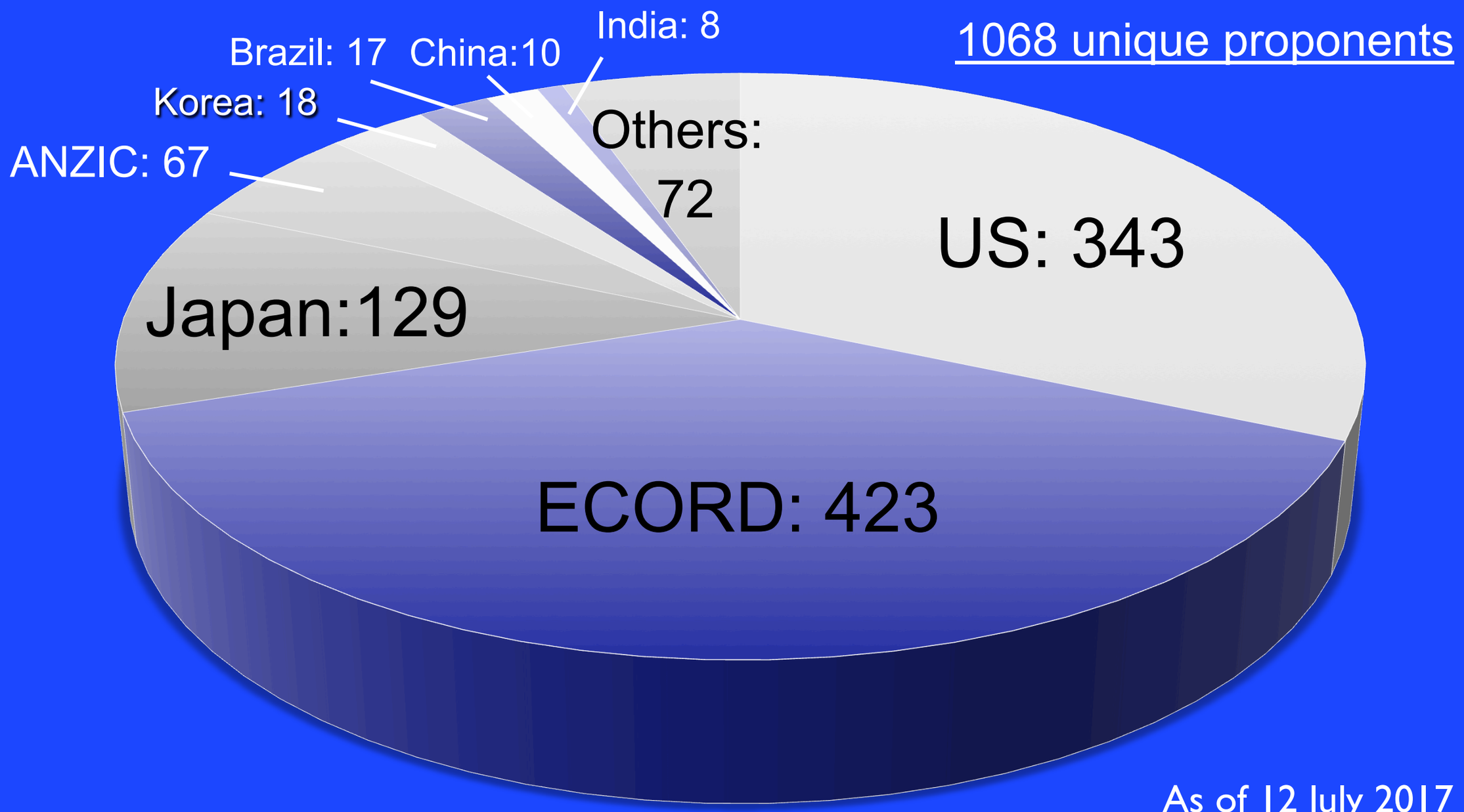


by lead proponent's member affiliation



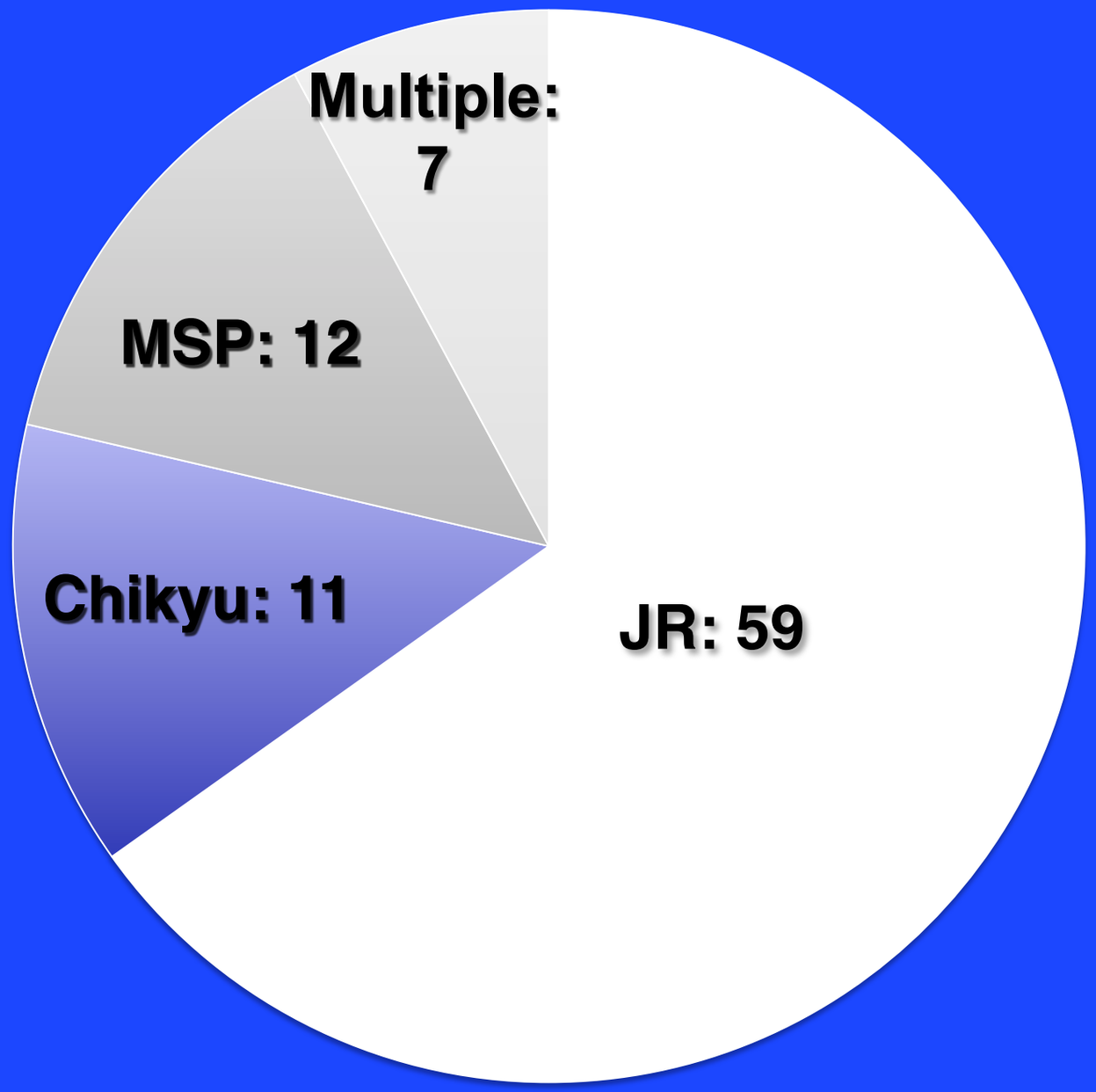
As of 12 July 2017

Active proponent distribution



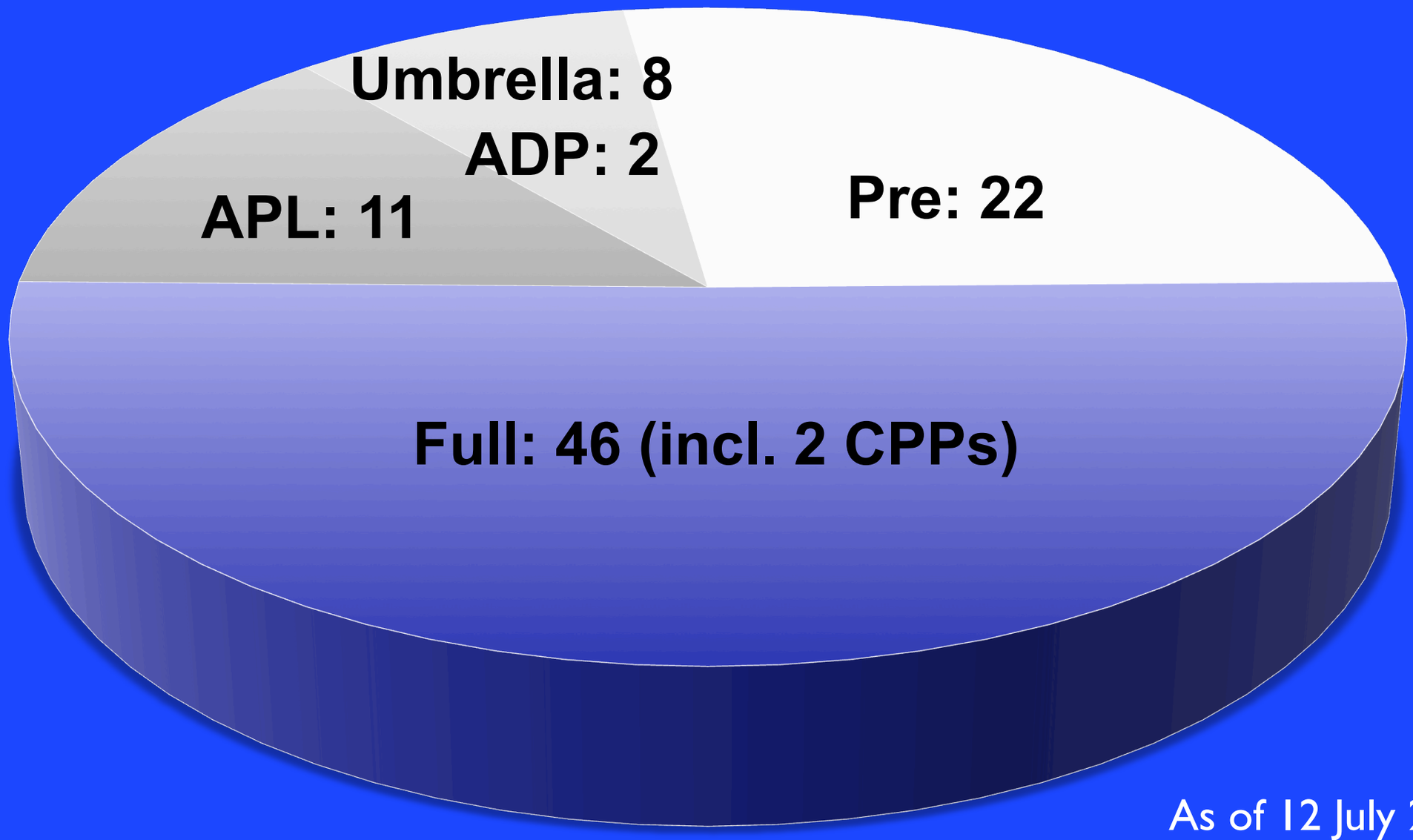
As of 12 July 2017

Drilling Platforms: 89 Active Proposals



As of 12 July 2017

Active proposals: 89 by proposal category



As of 12 July 2017

Parting thoughts:

- ***Overall, this phase of scientific ocean drilling is doing a good job of addressing the Science Plan's themes and challenges; however, this performance goes beyond the JR to MSP and Chikyu-hosted expeditions. The JR cannot do it all.***

- ***The body of active proposals, and the flow of new proposals, seems adequate to sustain IODP through its next phase (even with the JR at full utilization).***

- ***The assessment of how proposals and expeditions are answering the call of the Science Plan themes/challenges does not include any post-expedition assessment, by SEP/FBs/Co-Chiefs/IODP Forum,… The international scientific ocean drilling community could and should take this on as an important ongoing priority, as we begin to envision a post-2023 program.***

Thank you! Questions? Comments?