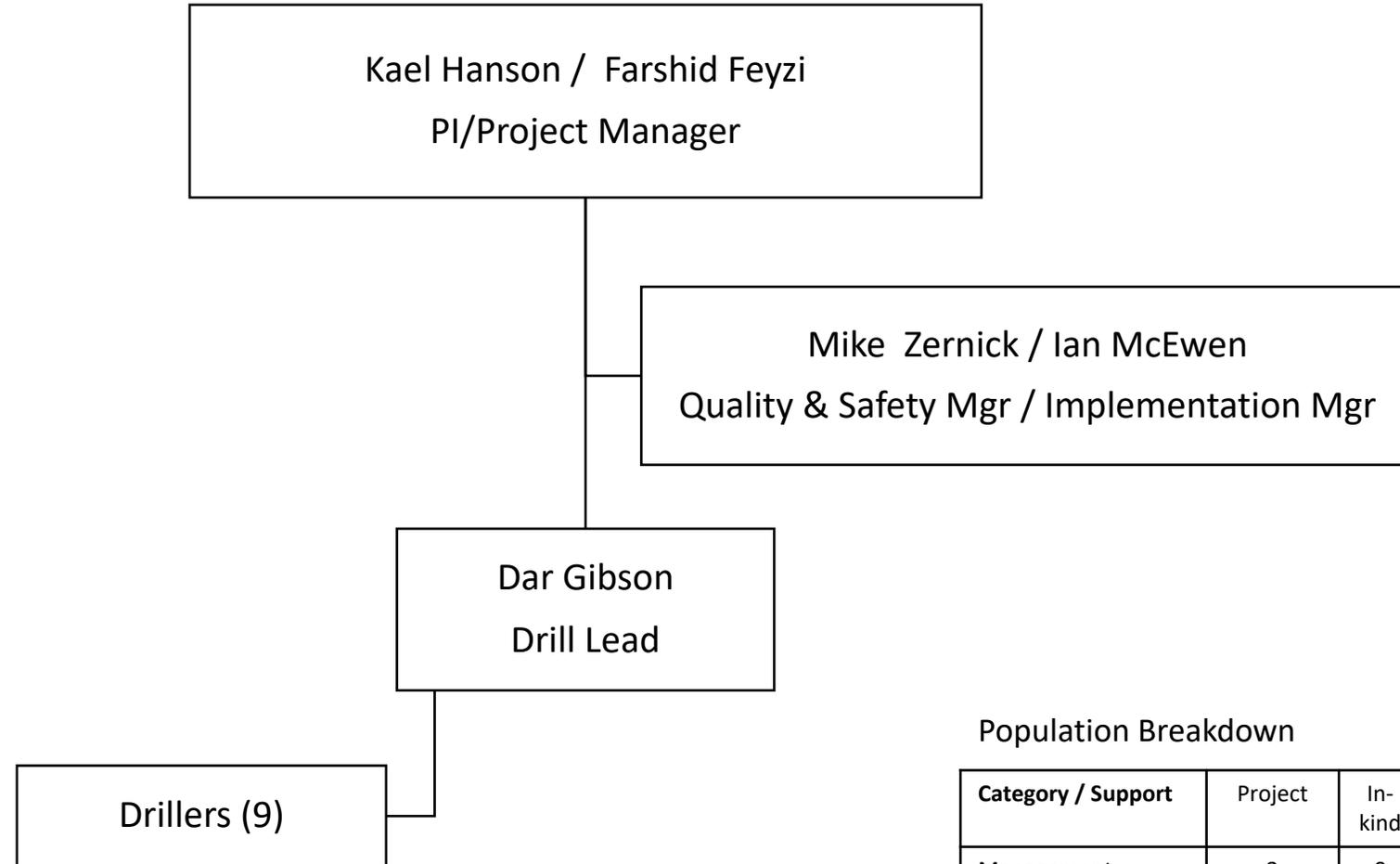


IceCube Upgrade Logistics: Population



- Season 1:
 - Outfitting of subsystems
 - Subsystem-level integration and testing
 - Seasonal Equipment Site (SES) setup
- Season 2:
 - Full drill system integration and testing
 - Full power wet test
 - Firn drilling
 - Surface cable and Surface Junction Boxes Installation
- Season 3:
 - Deep Drilling
 - Installation
 - Mothball and Retrograde



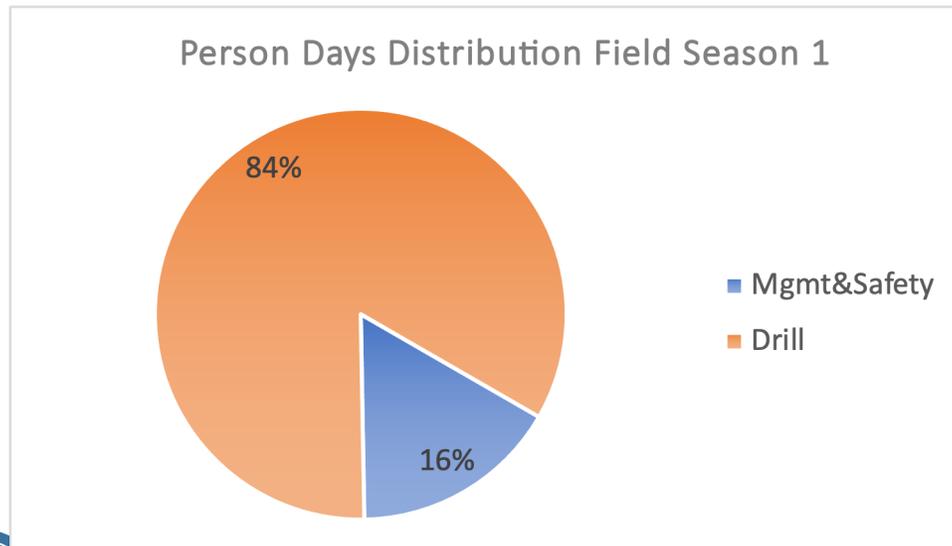
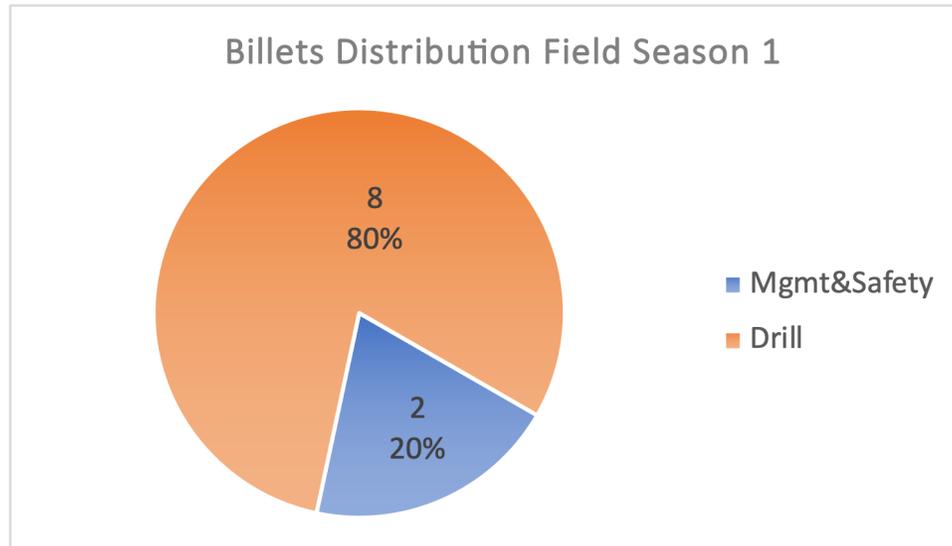


Population Breakdown

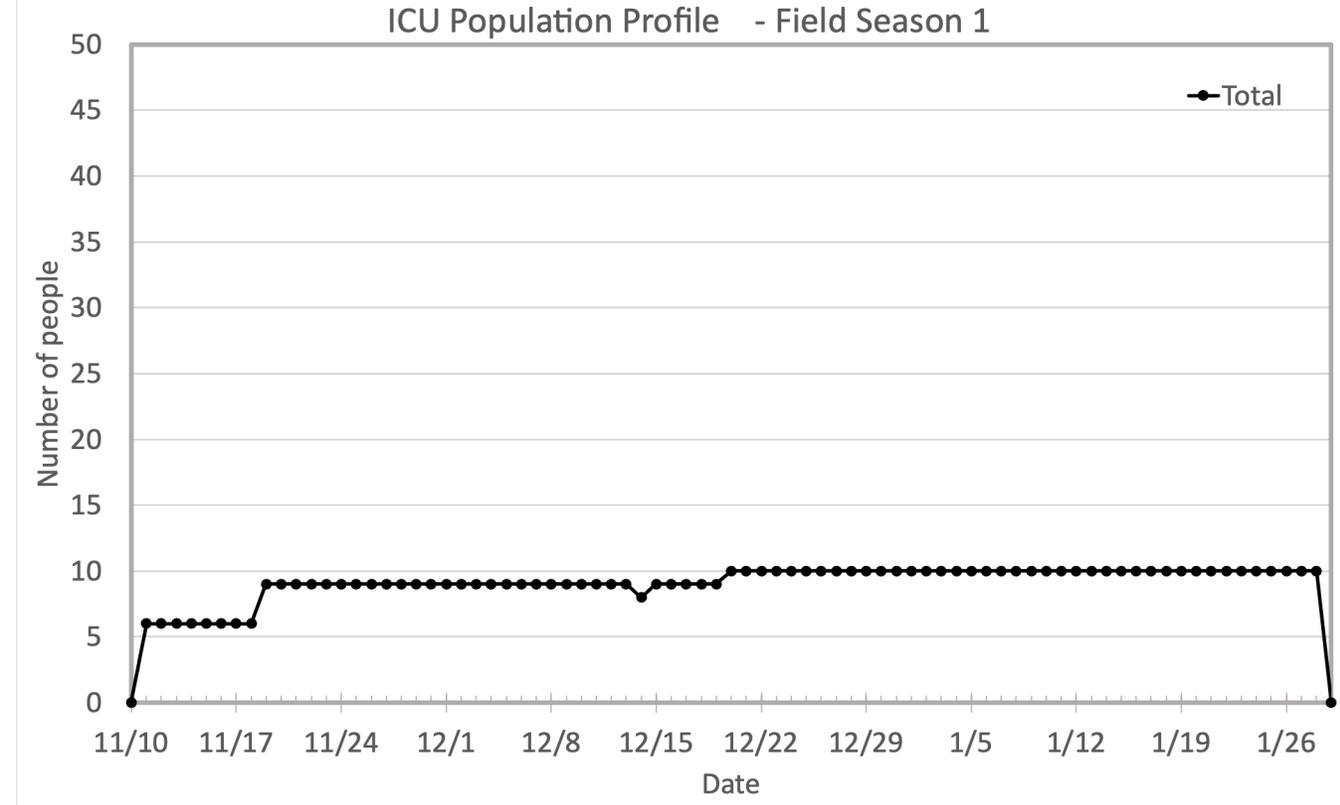
Category / Support	Project	In-kind	<i>Total</i>
Management	2	0	2
Drill	8	0	8
Installation	0	0	0
CPT/Eng/SME	0	0	0
Total	10	0	10

Winter-over and m&o personnel are not included in this chart.

Field Season 1 Population Overview



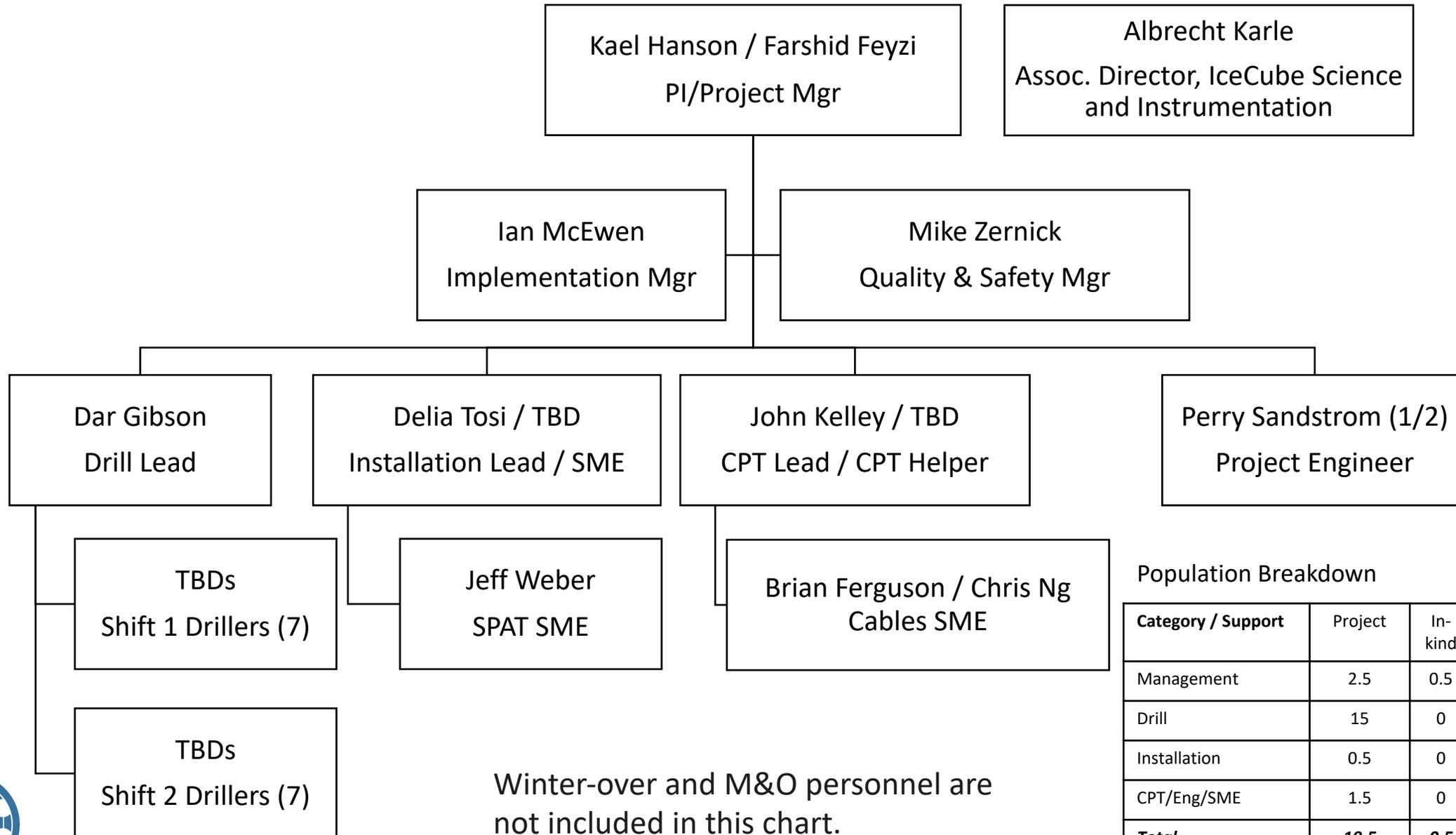
Winter-over and M&O personnel are not included in this chart.



Area	Billets (beds)	Person days	
Mgmt&Safety	2	119	average days per role
Drill	8	607	
Installation	-	-	
Comms Power Timing (CPT)	-	-	
Subject Matter Expert (SME)	-	-	
Integration/Commissioning	-	-	
Total	10	726	



Forecast IceCube Upgrade On-Ice Org Chart – Field Season 2



Winter-over and M&O personnel are not included in this chart.

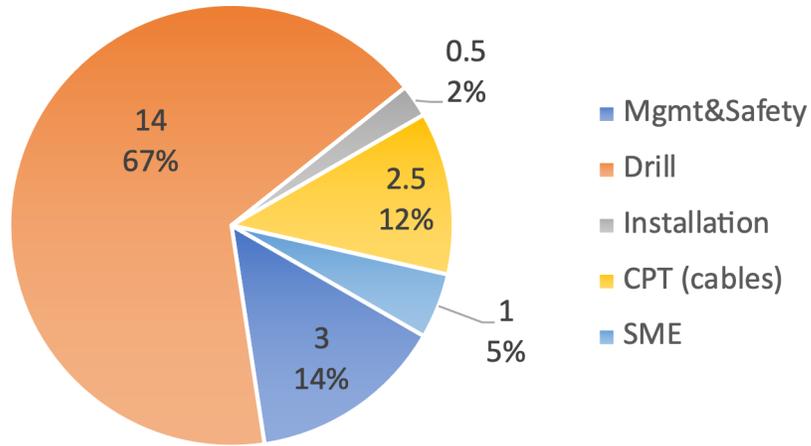
Population Breakdown

Category / Support	Project	In-kind	Total
Management	2.5	0.5	3
Drill	15	0	15
Installation	0.5	0	0.5
CPT/Eng/SME	1.5	0	1.5
Total	19.5	0.5	20

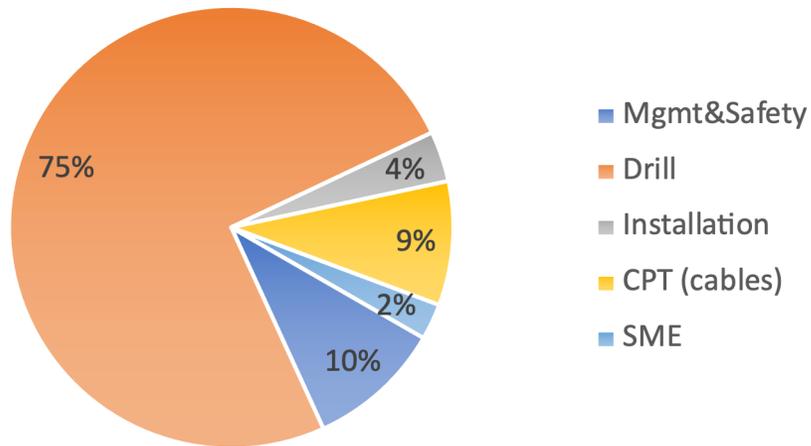


Field Season 2 Population Overview

Billets Distribution Field Season 2

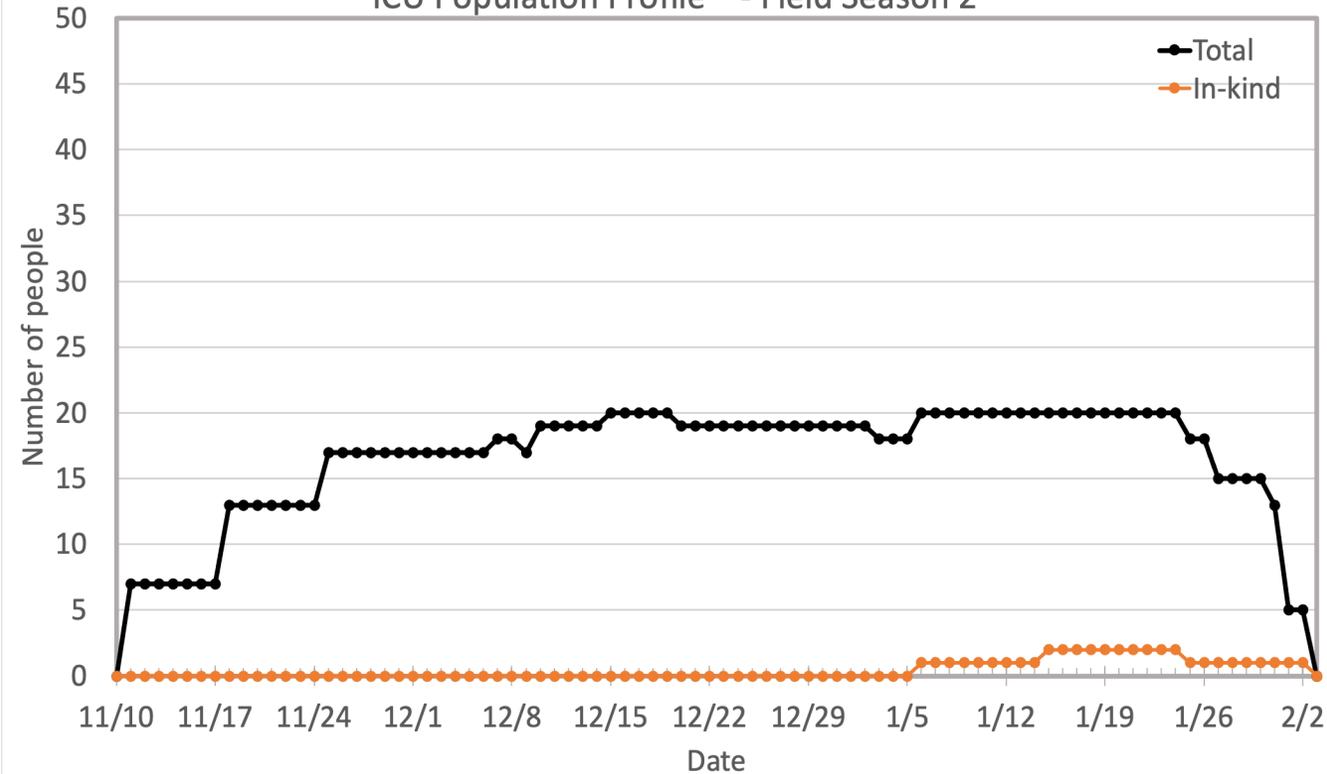


Person Days Distribution Field Season 2



Winter-over and M&O personnel are not included in this chart.

ICU Population Profile - Field Season 2



Area	Billets (beds)	Person days	
Mgmt&Safety	3	139	average days per role
Drill	14	1055	
Installation	0.5	52	
Comms Power Timing (CPT)	2.5	128	
Subject Matter Expert (SME)	1	37	
Integration/Commissioning	-	-	
Total	21	1411	



- **Field Season 2**

- Full systems integration, SES – Main heating plants, pump systems, preheat system, water tanks, Rodwell system, WISSARD HPU, generators, hoses, cables, control system and motor drives
- Full systems integration, TOS – Towers, structures, reels, control system and motor drives
- Load share testing
- System commissioning and testing
- Full system wet test
- Condensate bulb creation
- Drill 9 firn holes – 7 for deep holes, 1 for Rodwell, 1 for condensate bulb
- Complete remaining generator work and fully integrate/test all 3 generators
- Receive drill hose and install on Drill Supply Hose Reel
- Implement winter heating system for DSHR, DCC, TOS1, TOS2

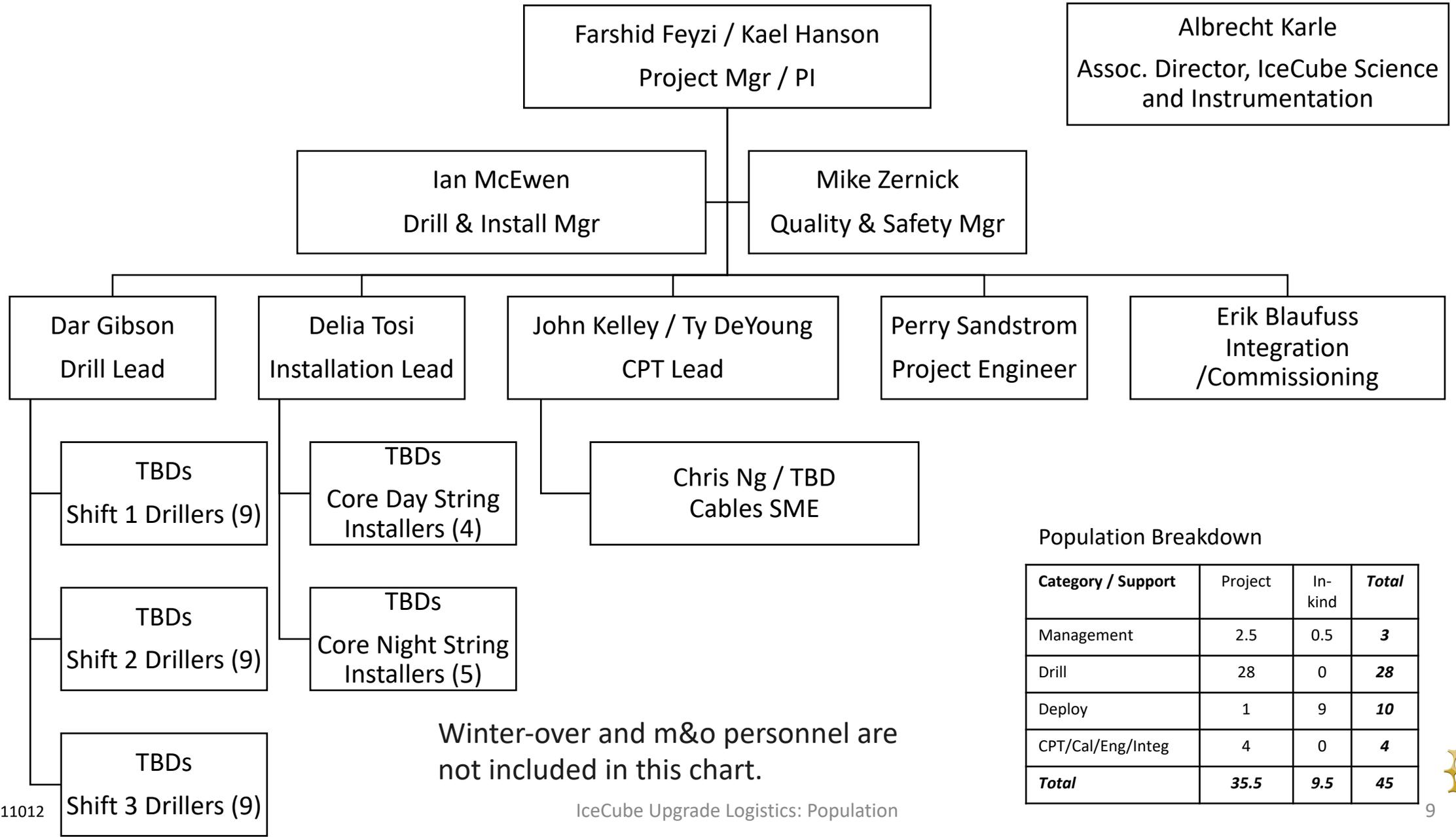
14 Drillers



- **Field Season 2**
 - manage surface cable trenching
 - install patch panels into ICL
 - manage excavation of west tower
 - pull 7 surface cables into ICL
 - install SJBs and connect surface cables to the SJBs
 - install SJB season covers and manage trench backfill
 - install surface cable grounding clamps at ICL entry
 - install patch panels in the ICL and connect surface cables
 - test installed cables from ICL to SJB
 - install Upgrade timing and power electronics into the ICL
 - commission Upgrade timing and power electronics
 - install patch cables to FieldHub rack locations
- **Personnel:**
 - 1 Cable SME (swaps mid season)
 - 1 Comms Power Timing expert (swaps mid season)
 - 1 Project Engineer (additional tasks)



Forecast IceCube Upgrade On-Ice Org Chart – Field Season 3



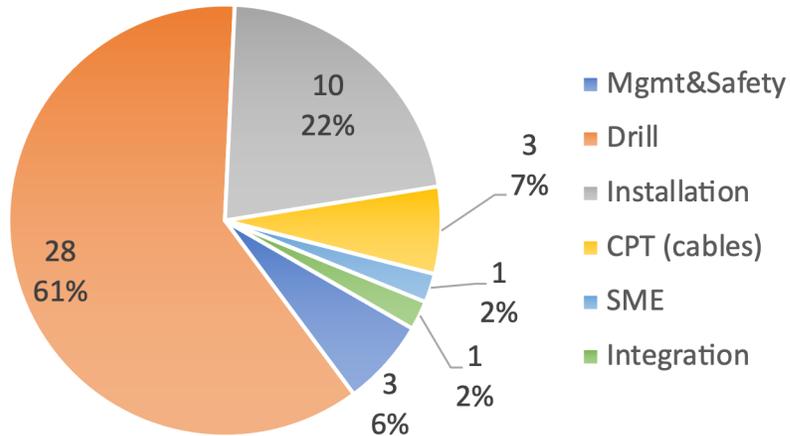
Population Breakdown

Category / Support	Project	In-kind	Total
Management	2.5	0.5	3
Drill	28	0	28
Deploy	1	9	10
CPT/Cal/Eng/Integ	4	0	4
Total	35.5	9.5	45

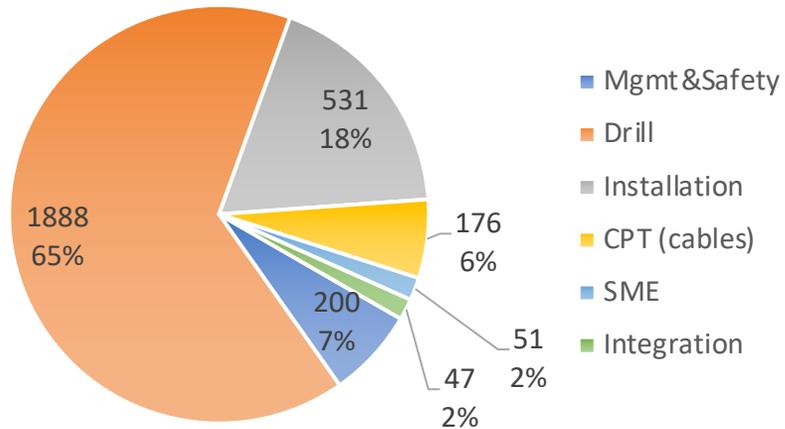
Winter-over and m&o personnel are not included in this chart.

Field Season 3 Population Overview

Billets Distribution Field Season 3

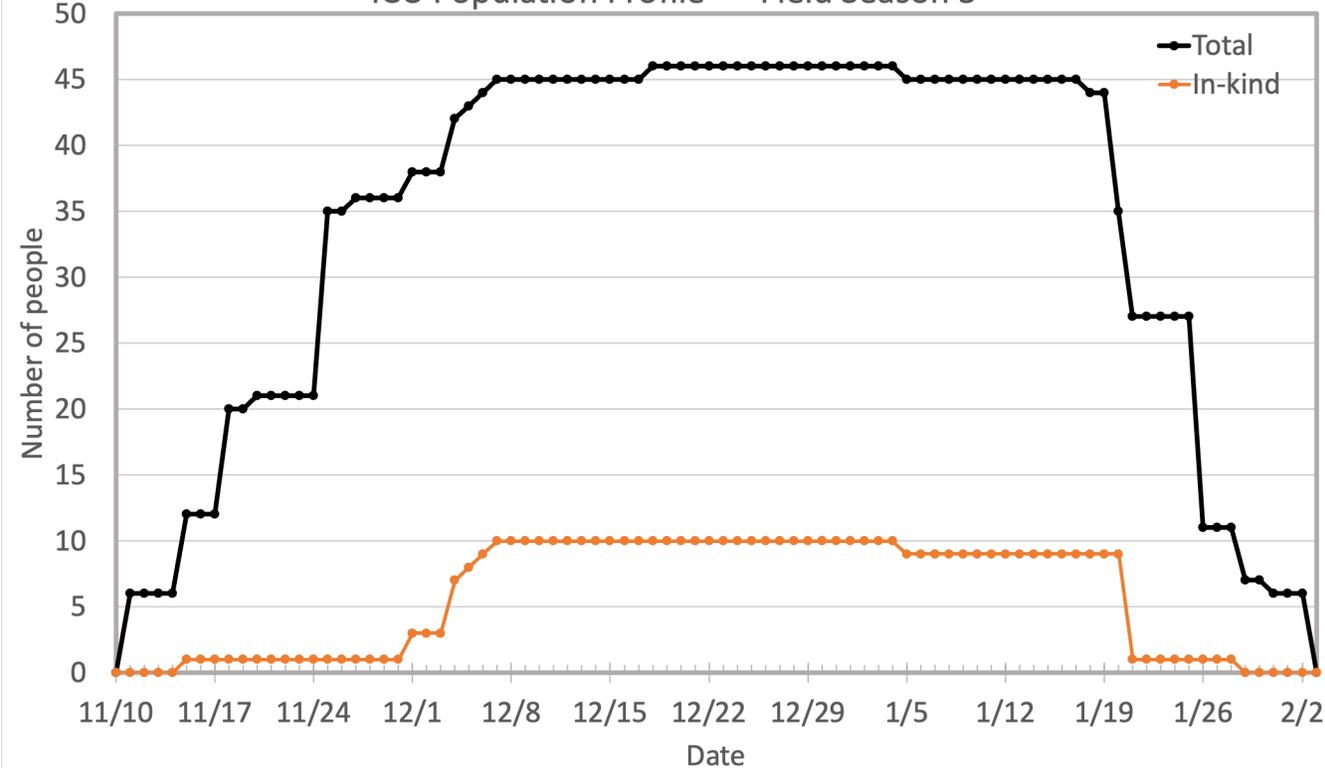


Person Days Distribution Field Season 3



Winter-over and M&O personnel are not included in this chart.

ICU Population Profile - Field Season 3



Area	Billets (beds)	Person days	average days per role
Mgmt&Safety	3	200	
Drill	28	1888	
Installation	10	531	
Comms Power Timing (CPT)	3	176	
Subject Matter Expert (SME)	1	51	
Integration/Commissioning	1	47	
Total	46	2893	63



- **Field Season 3**
 - Commission system
 - Startup tests
 - Drill 7 deep holes
 - Install 7 instrument strings
 - Decommission system
 - Storage and retrograde equipment

28 Drillers



Drill Crew Makeup

24/7 Operation

3 Shifts

9 Drillers/Shift + Drill Manager

28 Drillers

SKILLSETS

- Drill Manager
- Each Shift
 - Shift Lead
 - Deputy Shift Lead, Shift Safety Officer
 - DCC Operator
 - TOS Operator
 - Heater Expert
 - Electrical/Controls Expert
 - Mechanical Expert
 - Installation Experts
 - Equipment Operator
- Cross-Shift Expertise Required On-Site
 - Drill Engineer
 - Software Expert
 - Generator Tech
 - Electrician

Some key operations - examples

Hole Move

- 2 installation setup
- 1 SES
- 1 Hose reel move
- 2 Other reels move
- 2 Surface supply hose move
- 2 Surface return hose move

10 TOTAL

Installation

- 3 installation
- 3 prepare SES for drilling
- 3 prepare TOS for drilling

9 TOTAL

Lunch

- 2 SES
- 2 TOS
- 4 Lunch
- 2 People off (yesterday's skeleton crew)

10 TOTAL

Smooth Drilling

- 2 SES
- 2 TOS
- 2 Setup other TOS
- 1 Fixing something
- 2 people off (yesterday's skeleton crew)

10 TOTAL

If things are running smoothly, we can justify a crew size of 9 on days when yesterday's skeleton crew are off, or if someone is sick



- **Field Season 3**

- Oversee main cable assembly (MCA) spool loading on TU-20 prior to each hole
- Assist with breakout cable assembly (BCA) installation and DOM connectivity test during deployment
- Cable drag and cable connection to SJB after installation
- Perform connectivity test from ICL to in-ice devices. Isolate any problematic wire pairs and debug any connectivity issues.
- Connect ICL patch cables to FieldHubs
- Support DOM and special device commissioning and any in-water calibration operations
- Remove SJB shelter and oversee backfill.

- **Personnel:**

- 1 Cable SME (swaps mid season)
- 1 Comms Power Timing expert (swaps mid season)
- 1 Project Engineer (additional tasks)



For each string:

- Sensor Testing
- Staging of sorted sensors, special devices, and breakout cable assemblies in the sensor handling facility next to the TOS
- Installation proper list of tasks (per shift):
 - Shift lead (1x)
 - DOM suppliers (2x): sort sensors according to string deployment order in sensor handling facility
 - DOM supplier TOS side (1x): preps the next sensor
 - DOM installers (2x) : attach sensors to cable at the hole
 - Winch operator (1x): operate TU-20 and hoist
 - Logger (1x): Logs instrumentation, measures inter-sensor distance
- 5 dedicated installers / shift + 3 drillers (total of 8/shift)
- Total: 10 dedicated

