

April 2, 2018

TO: Dr. Margaret Leinen, Director, Scripps Institution of Oceanography
FROM: Dr. Arthur J. Miller, Head, Oceans and Atmosphere Section
RE: New Faculty Hiring Plan for the Oceans and Atmosphere Section



This is in response to your recent request for an Updated Faculty Hiring Plan for the Oceans and Atmosphere Section.

I first requested in December a list of potential research topics for targeting in open faculty recruitments, which resulted in roughly fourteen areas. We then met twice in 2018, on January 24 and March 19, to discuss priorities in faculty hiring. In the first meeting, it was suggested (and we agreed) that input from the curricular group coordinators (CGC's) would be essential for prioritizing research areas for targeting. I then charged the CGC's (Hildebrand for AOS, Keeling delegated for CS, and Feddersen for PO) with developing their own ranked choices for hiring, taking into explicit account the teaching needs of COAP (Gille serving as program director). They skillfully polled the curricular groups and assembled consensus plans for each discipline in COAP. In the second meeting, the representatives from AOS, CS, and PO presented their results. This precipitated a lively discussion of many intertwined topics including institutional priorities, curriculum coursework requirements, mentoring of new hires by senior scientists before retirement, and maintaining excellence in both research and academic training.

A major concern of the section is the apparently ad hoc limit of one FTE per section per year. Many felt that an imbalanced distribution of FTE could be justified based on many things (funding levels, cutting edge science topics, impending retirements, etc.) that would favor the OA Section. As a whole, the section suggests that an institution-wide discussion (viz., committee) be organized to plan strategic balance in new faculty hires. The presentation of the three section hiring plans at the April 30 meeting is a starting point for that aim.

A second major concern was the maintaining the necessary scientific expertise for the world-class academic programs established in COAP. An impending loss through retirements (possibly averaging one per year over the next six years) of the highly technical expertise in ocean acoustics, digital signal processing, and ocean waves that is required in AOS was particularly noted. Without concerted action to replace this expertise soon, SIO will lose its current national and international stature in this area. Similarly for CS, several retirements and the ever-increasing teaching needs for the new undergraduate Oceanic and Atmospheric Sciences major both threaten our ability to staff the core CS courses on atmospheric physics, dynamics and climate theory. While the case is less urgent in PO, we do face a need for fostering the next generation of theoreticians, sea-going experimentalists, and modelers.

Another concern of the section was the worry that if we target a particular research area any one year, there may not be the world-class Assistant-level or tenured-level expert available at the time of the ad. Keeping an ad open for a longer period of time might ameliorate that issue. Suggestions for putting out broad ads in “Anything the OA Section Does” each year were advanced, but this would clearly leave an onerous and possibly invidious task to the search committee each year. The possibility for “opportunity hires” was also advanced. This is where uniquely talented individuals could be courted when they become recognized for excellence in whatever research area they favor. It seems rather difficult, though, to separate this from freemason networking. Also, changing frontiers may alter our long-term perspective on what areas we should be targeting in searchers. Finally, we frequently may find that a superior Assistant-level hiring target in any cycle may be on the brink of tenure at their home institution. When such highly valued personnel are available it seems short-sighted to require that the appointment occur at Assistant level.

AOS set its top priority on a junior scientist in **Experimental Marine Acoustics and Digital Signal Processing**. This will fill a vital teaching void that will soon arise when Hodgkiss retires and will serve to sustain our program in ocean acoustics that is one of the very top programs in the nation and of vital interest to the Navy, with ongoing negotiations to fund more M.S. and Ph.D. students among active naval officers. By leveraging existing acoustics research programs, there would be little need for substantial startup funding. Two secondary priorities arose. One important area is **Ocean Robotics**, recruiting someone developing novel sensing techniques and platforms, including new autonomous sampling strategies. The infrastructure required for cutting edge instrumentation development and observation requires an engineering staff and knowledge of ocean-specific engineering skills. Classes taught in the new OA undergraduate major could feature the design of ocean vehicles and instrumentation. This potentially has overlap with the Jacobs School of Engineering for a joint hire, but because of its clear connection to the historically stellar reputation in instrument development here at SIO it should be given high attention in the hiring plan. Another secondary target could best be handled in a *cross-sectional agreement* to hire someone skilled in **Ocean Optics - Remote Sensing**, either from the biological, biogeochemical, or physical climate side, applied to various sensing platforms (satellite, aircraft or *in situ*). Optics is crucial in properly using satellite observations to probe the upper layers of the ocean on global scales and SIO needs to maintain a presence in this important field that provides essential information about ocean biogeochemistry on extended spatial and temporal scales, with broad interdisciplinary impacts. Teaching optics in the graduate AOS core curriculum is needed along with the potential classes in remote sensing at the undergraduate level. Over the last two decades SIO has had only one faculty member (Stramski) involved in research and teaching topics in ocean optics and optical remote sensing. The AOS group emphasized a strong need for this hire within the next few years to ensure an appropriate overlap before Stramski's retirement.

CS chose to focus on a broad ad that targets the **Hydrological Cycle** in climate. First and foremost, this person should be able to teach at least one of the 217ABC sequence. Beyond that, we seek an expert in theory, modeling, and/or observations, all broadly defined but linked to the atmospheric hydrological cycle, potentially involving expertise in coupled atmosphere-ocean variability and predictability, climate sensitivity, cloud physics, paleo studies, and/or water-carbon relationships. The secondary CS target is **Carbon Cycle Science**, which in a broad way recognizes the historical prominence that we have attained in measuring CO₂ and estimating carbon budgets on a global scale. This would also be a broad ad that could connect in

different ways to someone inclined to taking over leadership of the CO₂ and O₂ programs now led by Keeling, who could mentor the person before retirement. Tertiary interest was also expressed in Seasonal-to-Subseasonal (S2S) Forecasting, GFD Theory, and Data Assimilation and Modeling.

PO also adopted a wide-ranging strategy to target three key areas in a single ad. This would optimally allow whatever early-career superstar happened to be available in this grouping of high-value fields. **Observational Air-Sea Interactions** is an area in which we have excelled in recent decades, especially with Melville's accomplishments in establishing a vibrant research group that will require leadership after he retires next year. **Geophysical Fluid Dynamics Theory** is another area where we have had a historically strong contingent of brilliant and influential scientists. Salmon's departure in 2009, plus the eventual retirements of Hendershott, Young and Cessi, truly threaten our ability to offer world class GFD theory in the classroom. **Data Assimilation and Modeling** is an area in which we lost teaching expertise when Detlef Stammer departed more than a decade ago, leaving a gaping hole in our curriculum. There is very strong sectional support for a new faculty FTE in this field because we have numerous funded projects in the section that involve data assimilation and modeling, and these projects support graduate students who need mentoring. This area also might be ripe for linkage with the new Data Sciences Institute in a cross-departmental hire. Addition areas of interest were Polar/Cryospheric Science and the Hydrological Cycle.

Given the constraints of one FTE per year, I attempted to synthesize (on my own) the input of the three CGC's with my weighted understanding of the teaching needs of COAP and the sectional needs of maintaining scientific excellence in key areas while potentially targeting new lines of opportunity for groundbreaking research. I presented this proposed sequence of Assistant-level faculty hires at the March 29 meeting, which was well attended. While there was some unease expressed by several members in attendance, and although there has been no formal agreement within the OA section, I believe it represents a reasonable compromise among COAP and OA Section needs. If additional FTE are available in any year, the sequence below can be ratcheted up in time:

2018: Hydrological Cycle (CS)
2019: Air-Sea/Theory/Data Assimilation-Modeling (PO)
2020: Experimental Marine Acoustics/Digital Signal Processing (AOS)
2021: Remaining two areas of Air-Sea/Theory/Data Assimilation-Modeling (PO)
2022: Ocean Robotics (AOS)
2023: Carbon Cycle (CS)

I justify the Hydrological Cycle as our current-year (2018) target because of the clear need espoused concerning the CS core-courses sequence, the lack of hiring any true climate dynamicist since Evan and Xie in 2012, and the high-profile attention that this area of research has attained in society and at SIO (e.g., CW3E). A draft advertisement is already in hand.

Next year (2019), the broad Triple-Topic hire is meant to find the best of the crop of young people available in that grouping, which has potentially a lot of overlap. A sea-going upper-ocean observationalist might be adept at numerical ocean modeling, or a theoretician might very well have an interest in sophisticated techniques of data assimilation. So it is easily justified

because of the needs in all three areas. Two years later (2021), we can re-run the ad for the remaining two (or last) areas of expertise.

In two years (2020), our latest hire in Acoustics, Karim Sabra, will be in full swing and so it seems appropriate to bring in a junior colleague for him (and other senior MPL scientists) to mentor at that time. The AOS group expressed a strong desire for this hire to happen sooner than 2020, so that Kuperman and Hodgkiss could act as mentors and transfer their contacts and programs to a junior faculty member. The Ocean Robotics, again broadly defined, can take precedence in 2022.

The five-year time scale of searching in the field Carbon Cycle sciences is reasonably justified by the expectation that Keeling will be considering retirement and ready to mentor an early-career colleague at that time. Plus the AGAGE hire will have established their roots by then, too, and can have considerable input to the process.

Potential Pan-Sectional Hire:

2018/2019: Ocean Optics - Remote Sensing will require a champion to mobilize a contingent of scientists from each section to support this action (along the lines successfully employed in the current Biogeochemistry search, which the OA Section supported) and thereby bring it to the attention of the section heads and SIO leadership.

Potential Cross-Departmental Hires:

Ocean Robotics and Data Assimilation are two areas that might easily connect SIO with MAE in a split hire, as occurred with the Lucas UPP hire (Autonomous Platforms) and was proposed by our section in summer 2016 (for Data Assimilation and Modeling). If given the nod, we would start the process of contacting the relevant department chair to proceed. If this type of split appointment is pre-approved, the section will contact both MAE and the Data Science Institute to gauge interest.

For completeness, I close with a list of the other potential hiring areas that were mentioned by at least one person, some of which overlap or resonate with the areas that rose to the top: Coastal Processes, Cryospheric Science (ice cores and past atmospheric gases), Global Drifter Program, Data Science, Hydrometeorology of Extreme Events, and Seasonal-to-Subseasonal (S2S) Forecasting.