Preface

It is often said that advances in most fields of endeavor result from "standing on the shoulders of giants," and this meeting is no exception. In 1989, John Lumley, who needs no introduction to readers and researchers interested in turbulence, brought together leading thinkers and doers in turbulence to discuss the then-current controversies in the subject as well as to consider the role of public policy (and therefore funding) decisions that help to steer the field in either a direct way or through decisions which have unintended consequences. The meeting was international in scope and attendance and there resulted from this meeting a volume entitled "Whither Turbulence? Turbulence at the Crossroads." The present volume summarises the findings and presentations of another meeting that considered the broad question of "Whither Turbulence" in the context of the ubiquitous network of computers and networks. John Lumley was invited to and indeed enthusiastically supported it: "I am honored . . . .you have my blessing, for what it is worth." This simple statement is a testament to his kind demeanor. Unfortunately, John could not attend due to illness and sadly he passed away in late May 2015.

In the intervening years or so between Lumley's volume and the present one, much has happened and new giants have emerged in this, the oft-said "last unsolved problem in classical physics." A significant disrupter to and leader in our field is Professor W. K. "Bill" George who was also Lumley's student. From George, there have emerged many academic children and now grandchildren, each of whom continues to provide leadership and impact on the field. Given his 5-decade long career, the meeting, details of which are provided within these pages, was dedicated to Bill on the occasion of his 70th birthday.

In 25 years, the world of research in turbulence has changed to where computation and simulation has grown to become the third leg of the scientific stool. In fact, with the web/Internet, commodity computing, high-performance computing, and significant advances in experimental tools, especially particle image velocimetry, it could be said that what was a dream in 1989, say active control of turbulence, is

now becoming a reality because the three legs of the stool (theory, simulation, and experiment) have each advanced, and Bill has been leading the charge on at least two of those.

However, it remains to be seen what state we will be in 2040. The meeting in Cargese began 50 years after Gordon Moore predicted the future of the semiconductor: a doubling of computer processing speeds every two years. A look at Bill Reynolds' paper in the Lumley volume (Fig. 1, p. 342) suggests similar growth such that peta-flops are now reachable (as at 2008), with exascale computing on the near horizon (expected by 2020). One can imagine even further ubiquitous computational infrastructure and new and even more exciting methods, algorithms, and most importantly, ideas. But a significant issue now is data and this will continue to grow. In 1989, again with reference to Reynolds' paper, computer memory sizes were of order gigabytes, while in 2015, terabyte drives are ubiquitous and cheap. An example of drivers for increased data storage and bandwidth is the square kilometer array (radio telescope) that will produce about 30 exabytes of data per month, which will require a doubling of the current Internet traffic bandwidth, worldwide! One can imagine that while the turbulence community will continue to push the Reynolds number envelope, it will be in combination with other physicochemical processes (e.g., high-Schmidt-number turbulent mass transfer) over the full spectrum of scales (nano- to full scale, including planetary scale).

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