

# Why Support University Research?

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## ABSTRACT

The good reasons for broad industry support of university research in seismic exploration are many; companies across the hydrocarbon industry benefit in a wide variety of ways from their support. Nevertheless, geophysicists who would like for their companies to continue to support worthy university research consortia are increasingly confronted with the need to justify that support to management in terms of product that will pay off for the company *that year*. At the same time, independent oil and gas companies have seen little role for themselves in support of exploration research although these companies have for years benefited greatly from research developments across the industry, including those initiated and developed in universities.

Below is a compilation, with some comment, of reasons to support university research in general. Many of the reasons listed are specific to research within the Center for Wave Phenomena (CWP) at Colorado School of Mines, but research consortia at other universities could provide comparable lists of reasons that highlight their specific research efforts and contributions.

Various subsets of the reasons listed likely have appeal to different sectors of the industry, to different companies within each sector, and to different decision-makers. Most of the reasons listed, however, are valid to some extent for all companies whether they are major oil and gas companies, independents, service companies, or technology vendors.

This document has two parts. The first contains general comments on broad issues related to the need for industry-supported university research. Next is a list of 15 reasons for support of university research in general and CWP in particular.

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## GENERAL COMMENTS

**Reduction in size of industry research.**—Research groups in industry have reduced dramatically in size. Clearly, the demand for research in hydrocarbon exploration and production can and, likely, will increase on short notice, due among other reasons to changing political, economic, and demographic circumstances. The expertise and availability of students within the universities is vital to having the capability to intensify research when needed.

**Graduate education.**—Education of the future work force for industry (and, to a lesser degree, academia) is the primary mission of academia. Evidence of this is that graduates of CWP and elsewhere have proven to be such valuable assets to industry.

**Short-term focus of industrial research.**—Industrial research today is focused on short-term goals and tends to avoid risk. Research within CWP includes high-risk non-conventional approaches that cannot be (or at least are not being) pursued in today's industrial environment. By sharing the cost of supporting such risky research with many other sponsors (in the annual amount of \$40K/year for CWP support), the financial risk to each sponsor is minimized.<sup>1</sup> Aside from cost, however, support of novel university research must be based on more than whether or not the research done in a particular university project is applicable to industry problems *this year*, or whether or not a new idea has as yet been applied to field data.

**Breadth of collaborative contacts across academia.**—The research environment in CWP is particularly rich in the contacts that CWP members have with other parts of the scientific community. The faculty members of CWP maintain active and broad contacts with other groups in the scientific community (for example, in physics, mathematics, geology), both at CSM and in other universities, government research agencies, and industry. Through the Keck Chair at CSM, this interdisciplinary aspect of work at CWP can be expected to intensify. CWP thus functions as a communication channel involving scientists in a variety of other fields.

**Critical mass of expertise in specific research directions.**—The academic environment creates a unique opportunity to build scientific “schools,” or directions that, over the years, accumulate a critical mass of expertise in certain research areas

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<sup>1</sup>Although the emphasis here is on university *research*, the benefits of that research typically accrue to the sponsoring company as a whole, not just to its research branch. Unfortunately, within many companies, all such support is narrowly funneled through their research group. Thus, whereas the financial risk-to-benefit ratio for a company-wide bottom line may be negligible, the bottlenecked funding through just a single department forces penny-pinching in decisions on support of university research.

and produce results of great importance to the industry. Research within CWP in inversion/true-amplitude processing is one good example; innovations in migration at Stanford is another; another is the research developments in multiple suppression at Delft University; and the work in anisotropic wave propagation and inversion that CWP has systematically pursued is but a fourth example.

**Active research environment.**—An active research environment is required so that the students will have an education that both is comprehensive and involves students with issues that are relevant and timely with respect to those of interest to industry. The university research consortia provide such an environment.

**Free-ranging directions of research.**—At the same time, academia in general, and CWP in particular, is free and ought to be free to pursue lines of investigation that are not apparently practical on a short time scale, but that often yield results of ultimate importance. CWP members have participated, and are continuing to participate, in revolutionizing the way that the geophysical community views wave propagation and seismic processing, first through published papers, next through software releases (both proprietary and free, such as in Seismic Unix), and later through textbooks.

## 15 REASONS FOR SUPPORTING CWP

- **students (future employees)** - the \$40K annual fee is a drop in the bucket compared with recruiting, particularly as industry struggles to make headway against the large imbalance in demographics of its professionals. Support of CWP translates into support of both the undergraduate and graduate programs in geophysics at CSM.
- **student support** - research funding is the primary source of financial support for graduate education (current full cost of supporting a single CWP student is about \$46K per year)
- **ideas** - next to students, the initiation, development, and presentation of fresh scientific ideas has been the most valued product of CWP's research
- **early awareness of research developments** - oil-company sponsors can learn which CWP developments that they would like to have service-company sponsors pursue; similarly service companies can be prepared to respond to oil-company requests based on research developed within CWP
- **leveraging of research funds** - for the \$40K annual fee, a company taps into \$1.6M worth of research (by 16 graduate students and seven faculty) on a much broader range of topics than could be addressed by a single in-house researcher at six times the cost

- **software code** - over its history, CWP has produced 48 software programs that are proprietary to CWP sponsors. (Typically, our sponsors modify the code so as to make it most efficient and suitable for their purposes.) These programs represent our most advance developments; these days we produce several new proprietary codes each year.
- **Seismic Unix (SU)** - in addition to the direct value of SU to many researchers within our sponsor companies, this Unix-based seismic data processing system, which includes source code and is freely available to all over the internet, has been a catalyst for research developments in many universities and companies worldwide
- **Samizdat Press** - CWP's offerings of course notes and textbooks, which are freely available over the internet or Web through Samizdat Press, could not thrive without some of the support base provided by CWP
- **“basic research”** - with the demise of in-house research across the industry, universities have become the home to more risk-prone basic research and intermediate-term to long-term research that can yield scientific breakthroughs of strategic value to the industry
- **intellectual stimulation** - many sponsor representatives have commented that the presentations, tutorials, and discussions during our Annual Project Review Meetings are more scientifically stimulating than the SEG Annual Meeting and many other workshops, symposia, etc.
- **scientific interactions** - many sponsor representatives to these meetings also greatly value the active scientific interactions not only with faculty and students but also with other sponsor representatives
- **facilitated opportunities to develop collaborations** - both with CWP people and with those in other companies
- **extended visits to CWP** - through visits of days to weeks (and longer), researchers in companies have the opportunity to gain the most from our ideas and technology (including early application of our software to their data)
- **visits by CWP people to companies** - CWP personnel at times visit companies that are particularly interested in ideas, technology, and programs that have been developed within CWP; these visits could include overviews and tutorials on the research
- **marketplace of ideas** - whether at the CWP Annual Meeting or in Golden throughout the year, CWP provides a marketplace of ideas across companies and between university and company