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SHARED EARTH MODELING: A TRUE SYNERGISTIC APPROACH

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ABSTRACT

In order to develop an accurate shared earth model, companies must apply a true synergistic approach to multidisciplinary team studies. A shared earth model that can truly add value and upside potential to a company must implement its teamwork such that "The Whole Is Greater Than The Sum Of Its Parts."

THE SHARED EARTH MODEL

It is a truism that geologists, geophysicists, and engineers all work with a single earth. The model that each discipline develops must therefore be compatible with the model of every other discipline if the resultant model is to be correct. A shared earth model is a single model of a portion of the earth that seamlessly incorporates the observations, interpretations and data of each specialist involved in its development.

The requirement that a correct model incorporate data from all disciplines seems obvious, but this requirement is often overlooked. For example, most geophysicists incorporate log tops picked by geologists into their interpretation. Fault cuts identified by geologists on well logs are less frequently used, but faults observed in a well log should be visible on seismic if the missing section is greater than the resolution of the seismic data. Too often, fault cuts are not used by geophysicists to aid in the identification of subtle or complicated faulting. The reverse is also common. Geologists rarely check with geophysicists to see if seismically visible faults cut wellbores. If a fault is interpreted on seismic to cut a wellbore, the fault should either be observable by correlation in the well log or the seismic interpretation is incorrect. Too few geoscience teams actually perform these crosschecks to verify the accuracy of their shared earth model.

Crosschecking fault cuts in well logs with faults observed on seismic offers additional information about the velocity field used in the model. If fault cuts are clearly observed in well logs and on seismic data, but they do not tie, this may be an indication that the velocity model being used to relate seismic time to depth is wrong. Adjustment of the velocity model to allow the well data to tie the seismic data improves the entire model.

THE COMPOSITE BRAIN

Many problems being addressed by the petroleum industry require specialized knowledge about too many subjects to be adequately addressed by an individual. The need for multiple specialists has led to the creation of multidisciplinary teams in many E&P companies. Multidisciplinary teams can either function linearly or they can function synergistically to form what we term the "Composite Brain" (Fig. 1).

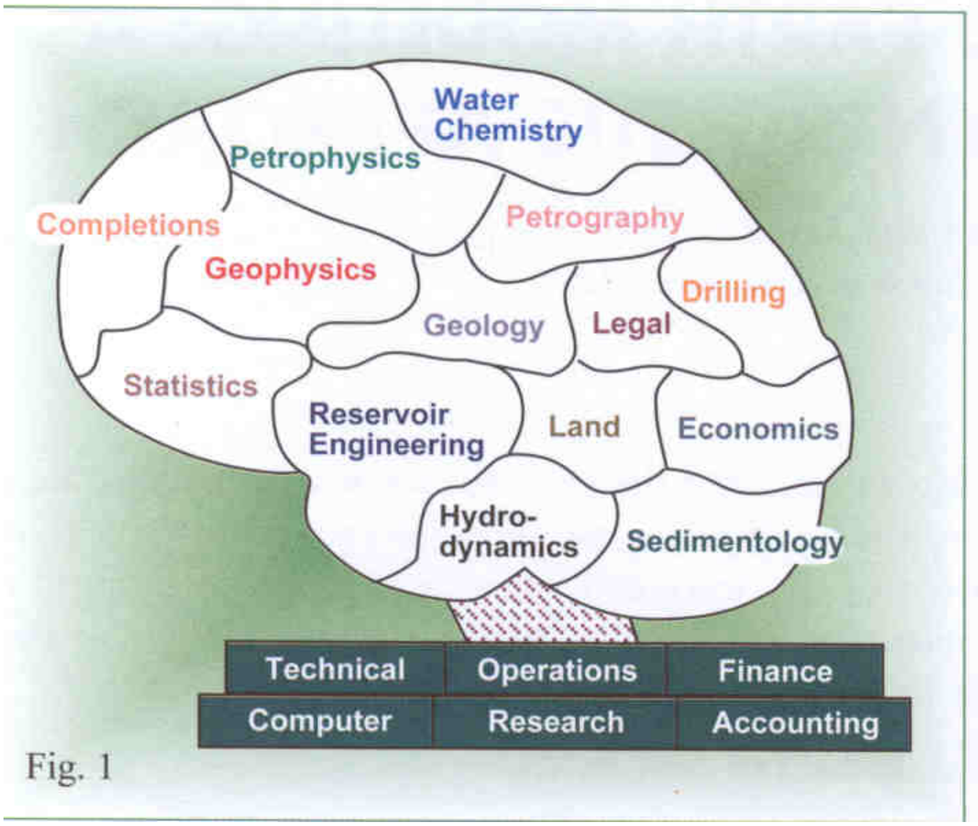


Fig. 1

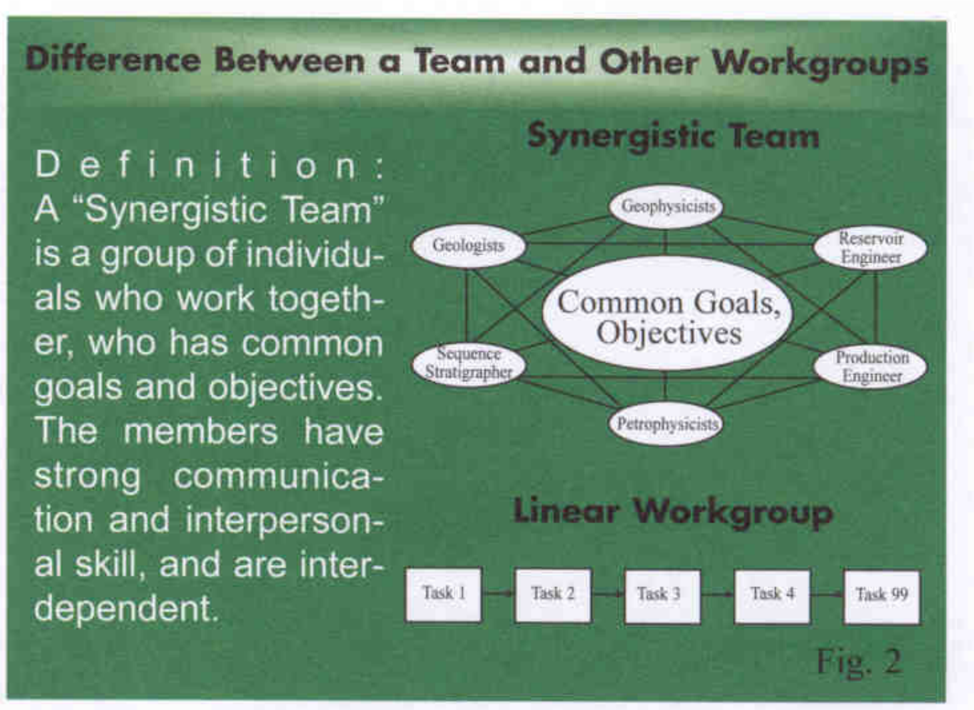
Linear Multidisciplinary Teams

If teams function linearly, each discipline does its work separately and sequentially. Consider the case of a multidisciplinary team studying an older field. The geologist first correlates the well logs and develops a general depositional model. The log tops are transferred from the paper well logs to the seismic data using some velocity model. The geophysicist uses the log tops to aid in his interpretation of the seismic data. If there are any discrepancies between the log interpretation and the seismic interpretation, the geologist may go back and modify the geologic interpretation as required. Once the geologist and geophysicist have reached a consistent interpretation, structure and isochore maps are generated. These maps are passed along to the reservoir engineer who compares well performance with volumetric estimates of reserves. If any production anomalies are identified, the geologist and geophysicist may review and modify their work again, as necessary.

Once production anomalies are resolved, the geologist, geophysicist and reservoir engineer identify any remaining potential. Drilling targets are passed alone to the drilling engineer who plans the well and estimates the drilling and completion costs. The well plan is passed back to the geologist who plots where the well will intersect each mapped horizon and fault. The reservoir engineer determines the current pressure of any reservoir intersected by the well plan and cost estimate to deal with any unexpected drilling problems such as drilling through depleted reservoirs. The reservoir engineer runs economics on the final cost estimate. If the economics are favorable, the project proceeds, if not, a new set of drilling targets may be passed to the drilling engineer to start the process again.

Synergistic Multidisciplinary Teams

Contrast the above workflow with that of a synergistic multidisciplinary team (Fig 2). In a synergistic team, work is done **in parallel** rather than in sequence and information flows in all directions in much the same way that different parts of our "Composite Brain" function together. The geologist, geophysicist and reservoir engineer all work on their tasks simultaneously, sharing information and discussing problems. A well plan is developed within the shared earth model generated by the rest of the team. The drilling engineer has real time feedback from the team regarding the well.



The real power of the synergistic team does not just lie in more effectively accomplishing the same set of tasks as the linear team. The real power of synergistic teamwork is unleashed when one team member observes something that explains another team member's data, opening the way for new concepts. Synergistic teams find answers to questions that linear teams never recognize, just as we can recognize problems and solutions using all of our senses that no individual sense could recognize alone.

The Role of Software

Properly designed software is of enormous value to the effective functioning of a synergistic team, acting as the neurons of the composite brain. The advantages of interpretation software has been most widely recognized by geophysicists who have used it to make the two-dimensional interpretation of 3-D seismic data much more efficient. Recent advances in geophysical interpretation software have begun to allow three-dimensional interpretation of 3-D seismic data, promising additional gains in productivity. Reservoir engineers have also eagerly embraced software for the creation of production databases, projecting decline curves and calculating economics.

Geologists have lagged in their use of computers for several reasons including the lack of digital log databases, limited computer proficiency and primitive software design. All of these problems are being addressed with solutions forthcoming, however, and geologists stand of the brink of a significant increase in productivity.

Recent developments in software integration are beginning to allow the use of a single database to store all information about a field, including geophysical, geological and engineering data. This database is, in effect, **a shared earth model**. Work done by one team member in terms of picking log tops, seismic horizons or designing a well path is instantly available to all team members. Team members no longer have to consciously share data; all data is available to all members of the team through the common database.

THE KEY TO SYNERGISTIC TEAM SUCCESS

Even well designed software will not automatically turn every multidisciplinary team into a synergistic team. Synergistic teams do not happen by accident. They are the result of careful planning and nurturing. Successful synergistic teams share several common characteristics.

Common Goals and Objectives

An effective team needs clearly defined directions and measurable results. Management must provide the overall goals and direction of a project. It is then up to the team itself to apply their overall knowledge and skills to develop and implement a plan centered around the common goals and objectives.

Planning

Planning is critical for an effective synergistic team. Project planning must be done by the entire multidisciplinary team. Each person must provide their thoughts, ideas and input to a final project plan. Proper planning identifies tasks on the critical path, insuring that one part of the multi-disciplinary team is not waiting unnecessarily on results from another part of the team. Planning is essential for organizing complex tasks, fostering good communication and obtaining results.

Communication

Successful synergistic teams have excellent communication between team members. Well-designed and integrated software can aid in this communication, but it is not enough. Our experience has shown that **physical proximity** is the biggest element in fostering communication within a team. Ideally, all team members should be located in a single common area that contains the necessary computers and data resources for the team. When team members are in a single room, information and ideas flow freely between team members. Team members feed off each other's energy and ideas, leading to breakthroughs in understanding.

When team members are dispersed, the tendency is to wait until it is convenient to share observations or request cooperation. Frequently it can be days or weeks before observations are shared; occasionally critical observations or questions **may even be forgotten**. Progress is steady but slow **and breakthroughs are rare.**

Interdependency

To develop a true, accurate shared earth model, multidisciplinary teams must implement a plan, performing complex tasks with a high degree of interdependency. The total project success depends on each team member for success. What each team member does affects the others, rather than performing as separate individuals in an independent linear process.

Management Support

Management support is essential for a successful synergistic team. Once management has created a team, clearly articulated its goals, and provided the necessary resources, the team must be provided the necessary autonomy and authority to accomplish its goals. Micro-managing multi -disciplinary teams is likely to prove stultifying, *preventing true synergy from ever developing*.

CONCLUSIONS

The upstream petroleum industry is rapidly moving toward the development of an accurate shared earth model for exploration as well as development projects. The corporate value of a shared earth model lies in its added value and reduction in costs. The added value is in finding more oil and gas resources with reduction in costs resulting from less dry holes, faster project completion and more accurate results.

A true shared earth model requires a synergistic approach to multidisciplinary team studies, the application of a proven technical philosophy, integrated into advanced software and management understanding and support. A shared earth model proves its value when ***"The Whole is Greater Than the Sum of Its Parts".***

REFERENCES

Tearpock, D.J. and Bischke, R.E., 1991, Applied Subsurface Geological Mapping, Prentice Hall, N.J., 649 p.

Tearpock, D.J., Bischke, R.E. and Brewton, J.L., 1994, Quick Look Techniques for Prospect Evaluation, SOG Press La., 286 p.

Spiegel, J. and Torres, C., 1994, Manager's Official Guide to Team Working, Pfeiffer & Company, 159 p.

Tearpock, D.J., 1994, Synergistic Team Organization/Field Study Methodology, (A Short Course), Subsurface

Consultants & Associates, 230 p.

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