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PROGRESS REPORT

NO. 11

DEVELOPMENT OF IMPROVED BLOWOUT PREVENTION PROCEDURES TO BE USED IN DEEP WATER DRILLING OPERATIONS

Submitted To

THE UNITED STATES GEOLOGICAL SURVEY

Department of the Interior

Reston, Virginia

LOUISIANA STATE UNIVERSITY AND AGRICULTURAL AND MECHANICAL COLLEGE 1860

PETROLEUM ENGINEERING DEPARTMENT

Louisiana State University

Baton Rouge, Louisiana 70803

November 15, 1981

PROGRESS REPORT

August 16, 1981 - November 15, 1981

Development of Improved Blowout Prevention Procedures for Deep Water Drilling Operations

Contract No. 14-08-0001-17225, Mod. 4
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November 15, 1981

RESEARCH OBJECTIVES

The primary objectives of the proposed research are the development of improved blowout prevention procedures to be used in deep water, floating drilling operations. The overall research plan was divided into eight tasks which would take approximately four years for completion. The project is now in the fourth and final year. The eight tasks are as follows:

Task Description

1. Design of well for accurately modeling blowout control operations on a floating drilling vessel in deep water.
   a. Well scaling and design.
   b. Preparation of bids and specifications.
2. Construction of well for accurately modeling blowout control operations on a floating drilling vessel in deep water.
   a. Procurement of well equipment.
   b. Well drilling and completion.
3. Documentation of blowout control equipment configuration and procedures used on all floating drilling vessels capable of drilling in deep water.
   a. Equipment configuration.
   b. Shut-in procedures.
   c. Start-up procedures.
   d. Pump-out procedures.
4. Experimental study of shut-in procedures for blowout control on floating drilling vessels in deep water.

a. Experimental determination of frictional area coefficient profile of modern adjustable chokes and HCR valves used in blowout control operations.

b. Experimental determination of frictional area coefficient profile of modern annular blowout preventers during closure.

c. Development of mathematical model of pressure surges occurring during well closure.

d. Experimental evaluation of pressure surge model.

e. Determination of optional shut-in procedures for various well conditions.

5. Experimental study of procedures for handling upward gas migration during the shut-in period.

   a. Evaluation of conventional approach requiring use of surface drill pipe pressure.

   b. Evaluation of volumetric methods.

   c. Laboratory investigation of gas bubble fragmentation while rising in a static annulus.

   d. Development of mathematical model of well behavior during shut-in period following a gas kick.

   e. Determination of optimal method of handling upward gas migration during shut-in period.

6. Experimental study of start-up procedures for blowout control on floating drilling vessels in deep water.

   a. Evaluation of present day start-up procedures which use existing equipment.

b. Evaluation of possible future start-up procedures which would require development of new equipment.

c. Experimental determination of improved start-up procedures.

7. Experimental study of pump-out procedures for blowout control operations on a floating drilling vessel in deep water.

   a. Evaluation of present day pump-out procedures which use existing equipment.

   b. Evaluation of present day pump-out procedures which would require development of new equipment.

   c. Experimental determination of improved pump-out procedures.

8. Determination of well behavior during the control of gas kicks on floating drilling vessels.

   a. Experimental determination of annular pressure behavior for various well conditions.

   b. Development and verification of accurate mathematical model of well behavior during kick pump-out.

ACCOMPLISHMENTS

Task 1, well scaling and design, has been completed. Details of the design of both the well and the related surface equipment were presented in our last annual report.

Task 2, construction of the research well facility, is also complete. Formal dedication of the new facility was held on October 30, 1981 and was attended by the technical coordinator of this project. Experimental work using the new facility began on July 4, 1981 and has been proceeding rapidly.

Data collection for Tasks 3, 4, and 5 are all essentially complete. Written documentation of most aspects of these tasks has been completed in the form of three Master of Science (MS) theses.

A considerable amount of experimental data concerning Tasks 6 and 7 has now been collected. Data collection is continuing and this work is now proceeding on schedule.

SIGNIFICANT PROBLEMS

We have recently experienced a failure in the Sperry Sun pressure transmission system used to monitor bottom hole pressure in the well during some of the experimental runs. A workover procedure to correct this problem is now being planned and industry assistance is being sought to help finance this work. It is not yet been determined if additional USGS funding will be needed because of this problem. A preliminary estimate of the total cost of the workover is $20,000.

SIGNIFICANT CHANGES

No additional changes in the project are felt to be desirble at this time.

Adam T Bourgoyne Jr

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