Data Collection

- The most important aspect of preparing the well plan is determining the expected characteristics and problems to be encountered
- Data are needed to gain insight used to develop the projected drilling conditions

Offset Well Data

- Drilling engineer is not responsible for selecting well sites
- He works with geologist for:
  - Understanding the expected drilling geology
  - Define fault block structure
  - Identify geological anomaly
- A close work relationship between drilling and geology groups can be the difference between a producer and an abandoned well
- Offset well selection depends on:
  - Depth of the prospected well
  - Countering the top of the formation in the area
  - A trimetric plot to add a third dimension of the area

Data Sources

- Common types of data used by drilling engineers are:
  - Bit record
  - Mud record
  - Mud logging record
  - IADC drilling report
  - Scout record
  - Log headers
  - Production history
  - Seismic studies
  - Well surveys
  - Geological contours
  - Data base or service company files

- Each type of record contains available data that may not be available in the other
- Many sources of dada exit in the industry
- Some operators consider the record confidential

- The drilling engineer must assume the role of “detective” to fined and locate the required data
- Source of data include bit manufacturers and mud companies
- These companies make these data available to the operator
- Log libraries provide log headers and scout tickets
- Internal company files contain drilling reports, IADC report and mud logs
- Many operators will gladly share old offset information if they have no current leasing interest

Bit Record

- An excellent source of offset drilling information
- It contains data available to actual drilling operation
- The headings provide the following information:
  - Operator
  - Contractor
  - Rig number
  - Well location
  - Drill string characteristics
  - Pump data
- The main body provides
  - Number and type of bits
  - Jet sizes
  - Footage and drill rate per bit
  - WOB and RPM
  - Hole deviation
  - Pump data
  - Mud properties
  - Drill bit grading
  - Comments

- Deviation help detect dog legs
- Comments provide hole problems
- Bit grading is very useful in planning to select the successful bit in the area

Drilling Analysis

- Bit record can provide more useful data if raw information is analyzed
- Cost per foot and pore pressure plot can be prepared

- Drill rate data from a well and an area can detect trends and anomalies
- Sudden change in the trend suggests some anomaly
- Cost per foot study are useful in defining optimum, minimum-cost drilling conditions
- A cost comparison of each bit run on all available wells in the area will identify the bit(s) and operating conditions
- The drilling engineer provides his expected rig costs, bit costs, and assumed average trip time
- The cost per foot calculation are completed with:

$$cost\ per\ foot = \frac{C_B + C_R(T_T + T_R)}{F}$$

C_B = bit cost, $
C_R = rig cost $/hr
T_T = trip time, hr
T_R = rotating time, hr
F = footage per bit run

Ex. The following table shows the data of two bit runs. Determine which drilling condition should be followed in the prospect well. The hourly rig cost is $500. The trip time from 7,150 and 8,000 are 6.0 and 6.6 hrs.

Well No.	Depth in, ft	Depth out, ft	Rotating time, hr	Bit cost, $
Well A	6,000 7,150	7,150 8,000	23 20	1,660 1,650
Well b	6,000	8,000	42	2,980

For well A

Cost per foot for bit 1 = (1,650+ 500(20+6))/1,150
= $14.04/ft

Cost per foot for bit 2 = (1,650+ 500(20+6.5))/850
= $17.53/ft

Cumulative cost = 14.04x1,150 + 17.53 x 850 = 31,046.50

Cumulative cost/ft = 31,046.50 / 2000 = $15.524/ft

For well B = (2,980 = 500(42+6.5))/2000
= $13.62/ft

- Since the cost per foot in well B is lower than that of well A, the drilling condition from well be should be implemented

Mud Records

- Describes the physical and chemical characteristics of the mud system
- Prepared daily
- Many drilling personnel believe that it is the most important and useful planning
- Mud engineers prepare a daily mud check report form
- Copies are distributed to the operator and drilling contractor
- The form contains current drilling data as the following:
  - Well depth
  - Bit size and number
  - Pit volume
  - Pump data
  - Solids control equipment
  - Drillstring data
- It also contains mud properties data such as:
  - Mud weight
  - pH
  - Funnel viscosity
  - Plastic viscosity
  - Yield point
  - Gel strength
  - Fluid loss
  - Chloride content
  - Calcium content
  - Cation exchange capacity or MBT
  - Solids content
  - Oil content

- Analysis of the data gives clue of drilling problems
- An increase in yield point, water loss, and chloride content gives an indication of kick problems or salt zone drilling

Drilling analysis

- Depth versus days plot
- It is important for well cost estimation
- Analysis of plots of offset area can provide the following information:
  - Expected drilling time for various intervals
  - Identification of better drilling conditions by examining the lowest drilling times of offset wells
  - Location of potential problem zones comparing common difficulties in the wells

IADC Reports

- Drilling contractor maintains a daily log of drilling operations, drillstring characteristics, mud properties, and time breakdown for all operations
- These reports are normally available to the drilling contractor and operator
- It cannot be obtained for offset wells analysis without the operator's cooperation

Scout Tickets

- Has been available for commercial services for many years
- Prepared by oil company representatives who scout operations of other oil companies
- Current scout ticket contains a brief summary of the well
- It contains the following
  - Well name, location, and operator
  - Spud and completion data
  - Casing geometries and cement volumes
  - Production test data
  - Completion information
  - Tops of various geological zones

Mud Logging Records

- It is a foot by foot record of the drilling, mud and formation characteristics
- Used in high pressure and troublesome wells
- Considered the best source of penetration rate data for analysis purpose
- Seldom available to groups other than the operator
- It includes the following parameters:
  - Penetration rate
  - Bit weight and rotary speed

- Bit number and type
- Rotary torque

- It contains also many drilling-related parameters:
  - Mud temperature
  - Chlorides
  - Gas content
  - Lithology
  - Pore pressure analysis
- Pore pressure can be computed from d-exponent

Log Headers

- Drilling records are not available in all offset wells
- Log headers can yield useful drilling data
- Log headers include the following data:
  - Logging depth
  - Mud weight and viscosity of each logging depth
  - Bit size
  - Inferred casing sizes and actual setting depth
- In some cases, drilling and well logging problems are noted on the log

Production History

- Production records in the offset area can provide clues to problems that may be encountered in the prospect well
- Production can reduce the formation pressure
- Production records provide pressure data from the flowing zones

Seismic Studies

- Proper analysis of the seismic reflections can eliminate the wildcat status of the well by predicting the pore pressure to be encountered
- Good agreement on pore pressures can be attained between seismic analysis