

# Framework for Audit Oversight

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**INTERNATIONAL WORKSHOP ON  
ACCOUNTABILITY IN SCIENCE AND  
RESEARCH FUNDING**

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National Science Foundation





# Overview

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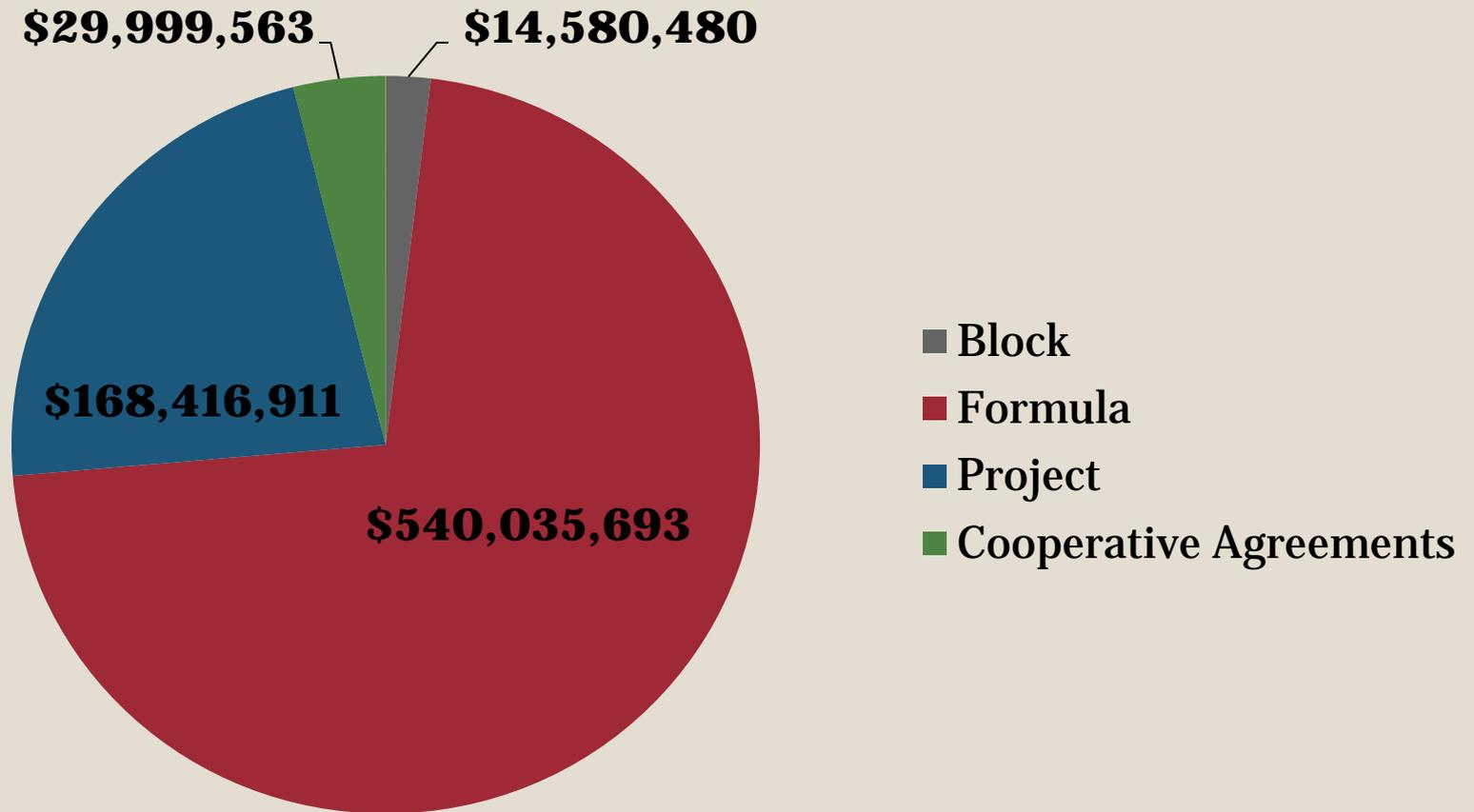
- Forensic Audit and Oversight
- Forensic Techniques Identify Anomalies
- Framework for Grants Oversight
- Forensic Auditing Results



# Federal Grants FY 09

## Total: \$753 Billion

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Source: U.S Census, Federal Assistance Award Data System, FY 09 Q1-4



# Grants Differ From Contracts

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## GRANTS

Intellectual Services for  
Public Good

- Award Budget
- Drawdowns
  - Aggregate costs
- Salary percentages

## CONTRACTS

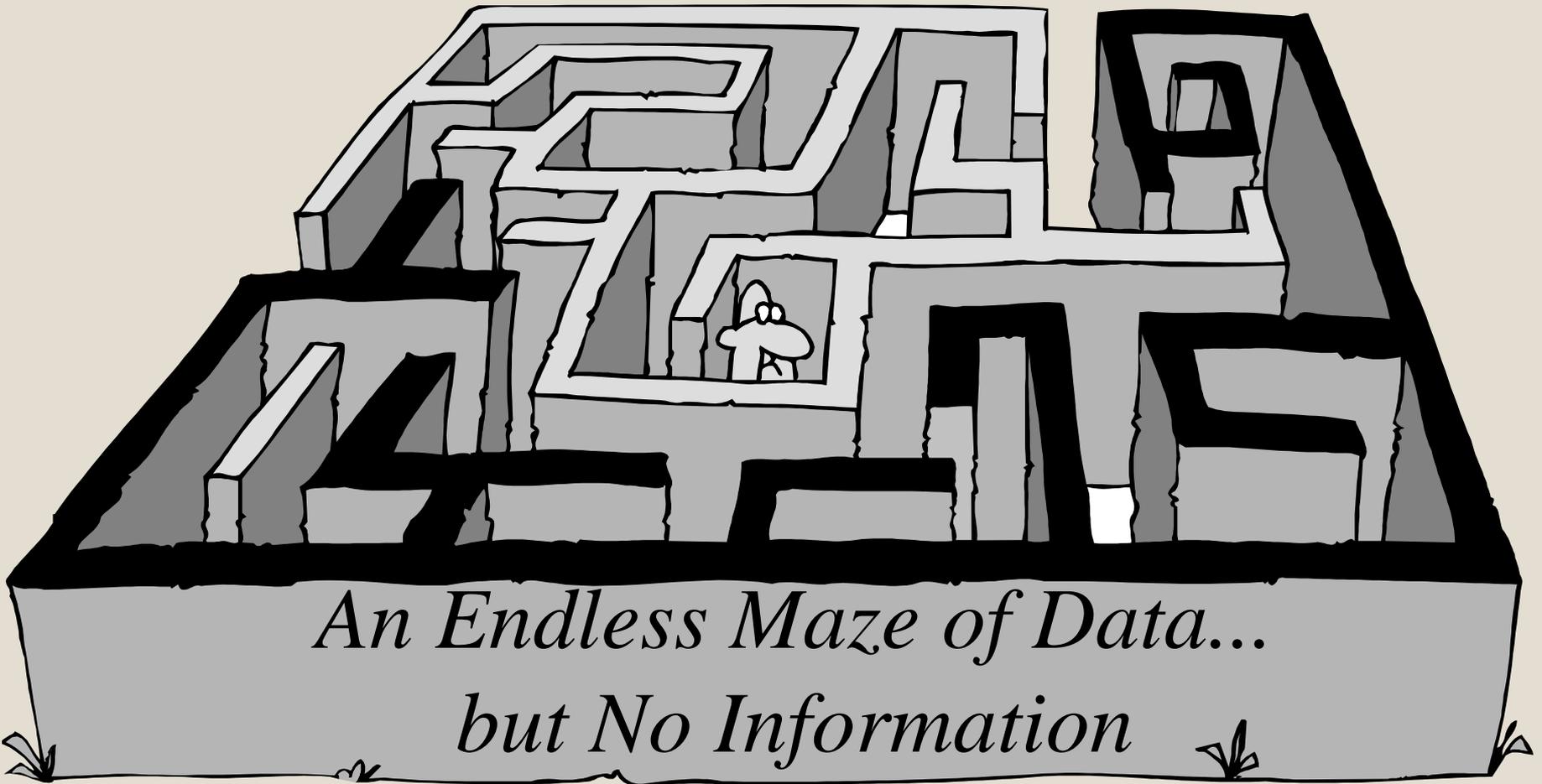
Specified Deliverables  
(Goods and Services)

- Contract Price
- Invoices
  - Unit costs
- Salary hourly rates



# Data Versus Information

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*An Endless Maze of Data...  
but No Information*



# Forensic Audit and Automated Oversight

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- Definition of Forensic Audit
  - Audit that looks for financial misconduct, abuse or wasteful activity
  - More than Computer Assisted Audit Techniques (CAATs)
- **Creates Relationships, Checks Calculations, Performs Comparisons**
  - Assess limitless number of analytical relationships
  - Summarize large volume of data
  - Database comparison



# Forensic Audit Techniques: Benefits

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- 100% Review Versus Statistical Sampling
- Tests not Limited to Predetermined Data Formats and/or Relationships
- Automated Oversight
  - Continuous monitoring
  - Quick response
  - **Confirm Audit Findings Have Been Corrected**
- Identify Anomalies to Review, Save Audit Time and Costs



# What is Data Mining?

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- The Use of Machine Learning and Statistical Analysis to Find Patterns in Data Sets
  - Use Structured Query Language (SQL): If You Know Exactly What You What to Find
  - Use Data Mining: When You Know Vaguely What You Are Looking for
- Data Mining May Confirm Audit Finding Was Corrected



# Forensic Techniques: Hardware and Software Applications

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- **Hardware**
  - SQL servers
  - Mainframe (QMF)
  - Docking stations
  - Terminal server
  
- **Software**
  - Data mining and predictive analytics, e.g., Clementine
  - Data interrogation – e.g., ACL, IDEA, MS Access, Excel
  - Statistical analysis – e.g., SPSS and SAS
  - Link analysis – I2
  - Lexis-Nexis
  - Data conversion utilities (Monarch)
  - Internet, open-source research
  - Access to system query tools



# Common Data Analysis Tests and Techniques

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- **Join**
- **Summarization**
- Corrupt data (conversion)
- Blank fields (noteworthy if field is mandatory)
- Invalid dates
- Bounds testing
- Completeness
- Uniqueness
- Invalid codes
- Unreliable computed fields
- Illogical field relationships
- Trend analysis
- Duplicates



# Growing a Forensic Audit Capability

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Audit programs should include data analysis steps

- Develop Organizational Capability
  - All audit staff should have basic skill with ACL, IDEA, Access
  - Forensic audit units perform more sophisticated analyses
  - Targeted Audits are more efficient in time and cost
- Phased Development
  - Hardware and software
  - Staff: system savvy, analytical, business process knowledge
  - Training, then immediate application to work



# ACL Test to Identify Grant Charges Near or Subsequent to the Grant Expiration Date

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File Edit Data Analyze Sampling Applications Tools Server Window Help

Command Line

```
EXTRACT RECORD IF NOT ISBLANK(NSF_Award_ID) AND Type_Entry_Code <> "54" AND c_Ledger_Post_Date > N02_Institution_Reconciliation.avid_exp_date TO "E01_Exp_Subsequent_Avid_Exp_Date" OPEN
```

Welcome E01 Extract

Filter: Index: [None]

Type Entry Desc	Grant Expiration Date	Transaction Date	Ledger Post Date	Object Desc	Financial Amount
1 Financial journals	09/30/2009	09/30/2009	10/06/2009	No Desc	51851.22
2 Financial journals	08/31/2007	02/29/2008	03/04/2008	WAGES - ACADEMIC	42392.71
3 Financial journals	07/31/2008	07/31/2008	08/11/2008	WAGES - ACADEMIC	32500.57
4 Financial journals	07/31/2009	07/31/2009	08/12/2009	WAGES - ACADEMIC	32273.83
5 Vendor check disbursement	07/31/2010	06/04/2010	08/11/2010	INVENTORIAL EQUIPMENT	31621.58
6 Financial journals	08/31/2010	08/31/2010	09/02/2010	WAGES - ACADEMIC	30530.51
7 Financial journals	08/31/2007	02/29/2008	03/04/2008	TUITION-FULL FEE REMISSION-RA	26600.19
8 Vendor check disbursement	08/31/2009	07/16/2009	09/10/2009	INVENTORIAL EQUIPMENT	23163.75
9 Vendor check disbursement	06/30/2010	07/15/2010	08/20/2010	3RD PARTY COSTS EXCLD FROM OH	22467.52
10 Financial journals	08/31/2009	08/31/2009	09/03/2009	WAGES - ACADEMIC	20740.00
11 Financial journals	07/31/2008	10/31/2008	11/06/2008	WAGES - ACADEMIC	20585.90
12 Financial journals	08/31/2007	02/29/2008	03/04/2008	OVERHEAD	20136.54
13 Vendor check disbursement	07/31/2009	07/08/2009	08/12/2009	3RD PARTY COSTS EXCLD FROM OH	20078.98
14 Vendor check disbursement	08/31/2010	09/15/2010	10/27/2010	3RD PARTY COSTS INCLD IN OHEAD	18725.30
15 Financial journals	08/31/2008	08/31/2008	09/04/2008	WAGES - ACADEMIC	17488.88
16 Vendor check disbursement	07/31/2009	07/27/2009	08/20/2009	3RD PARTY COSTS INCLD IN OHEAD	17197.52
17 Financial journals	07/31/2010	07/31/2010	08/11/2010	WAGES - ACADEMIC	16293.84
18 Financial journals	07/31/2008	07/31/2008	08/11/2008	WAGES - ACADEMIC	15754.23
19 Financial journals	06/30/2008	07/31/2008	08/11/2008	WAGES - ACADEMIC	15726.79
20 Financial journals	07/31/2008	07/31/2008	08/11/2008	OVERHEAD-CONTRACT&GRANT	15437.77
21 Financial journals	07/31/2009	07/31/2009	08/12/2009	OVERHEAD-CONTRACT&GRANT	15168.70
22 Financial journals	07/31/2010	07/31/2010	08/11/2010	WAGES - ACADEMIC	14799.73
23 Financial journals	08/31/2010	08/31/2010	09/02/2010	WAGES - ACADEMIC	14452.35
24 Financial journals	02/28/2009	03/31/2009	04/02/2009	WAGES - ACADEMIC	13836.40
25 Financial journals	04/30/2009	04/30/2009	05/05/2009	SERVICES - DEPARTMENT RECHARGE	12389.50
26 Financial journals	08/31/2009	08/31/2009	09/03/2009	WAGES - ACADEMIC	11933.32
27 Financial journals	06/30/2010	06/30/2010	07/02/2010	WAGES - ACADEMIC	11542.67
28 Vendor check disbursement	05/31/2009	03/25/2009	06/09/2009	MISCELLANEOUS SERVICES	10678.00
29 Vendor check disbursement	07/31/2009	09/17/2009	11/18/2009	3RD PARTY COSTS EXCLD FROM OH	10572.33
30 Financial journals	08/31/2009	08/31/2009	09/03/2009	WAGES - ACADEMIC	10563.99
31 Financial journals	07/31/2010	10/31/2010	11/04/2010	WAGES - ACADEMIC	10545.99
32 Financial journals	06/30/2008	06/30/2008	07/02/2008	WAGES - ACADEMIC	10323.71
33 Financial journals	08/31/2009	08/31/2009	09/03/2009	OVERHEAD-CONTRACT&GRANT	9851.50
34 Financial journals	07/31/2008	10/31/2008	11/06/2008	OVERHEAD-CONTRACT&GRANT	9778.30

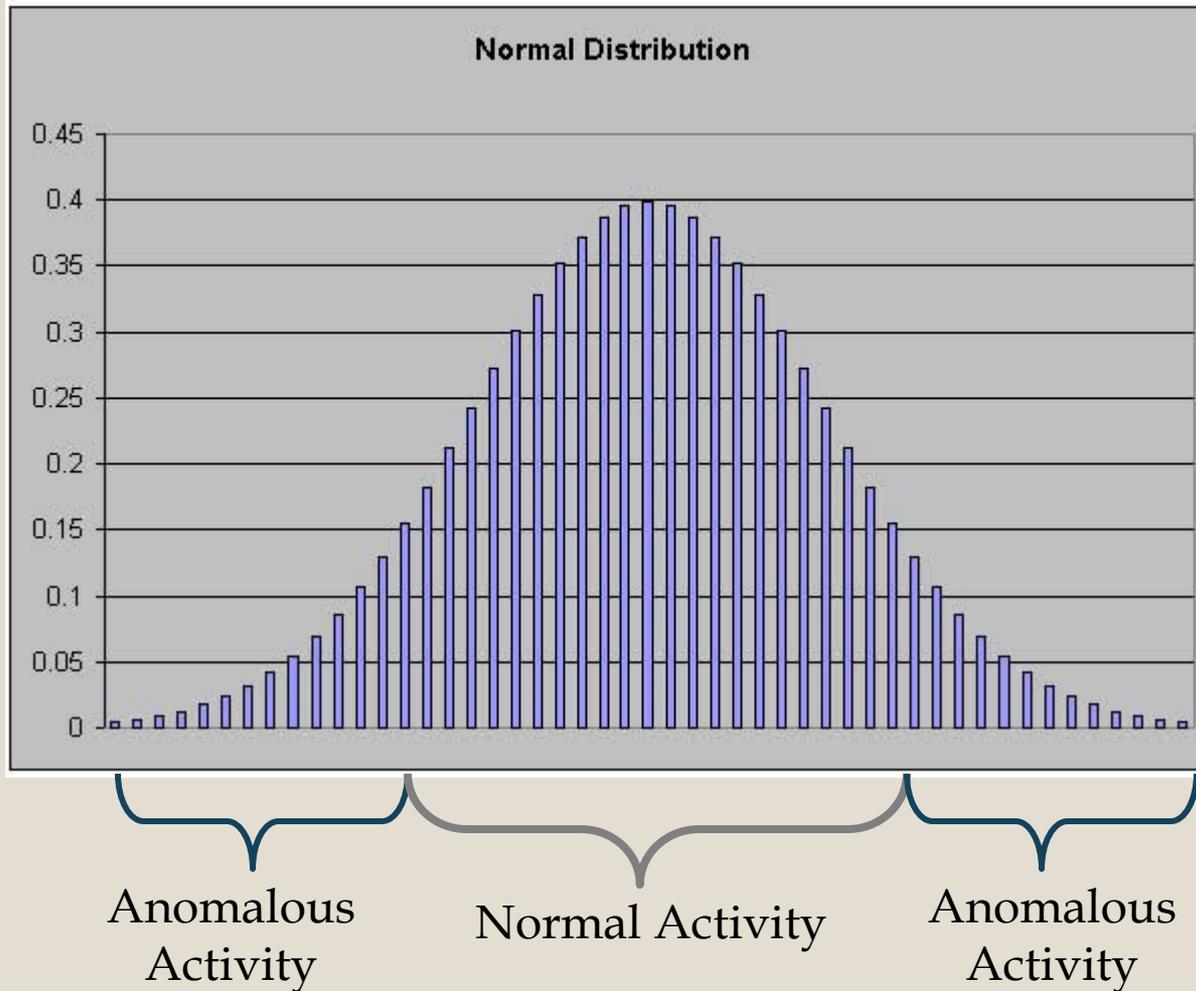
Default View

\*NSF OIG does not endorse any commercial software



# Focus on Anomalies/Outliers

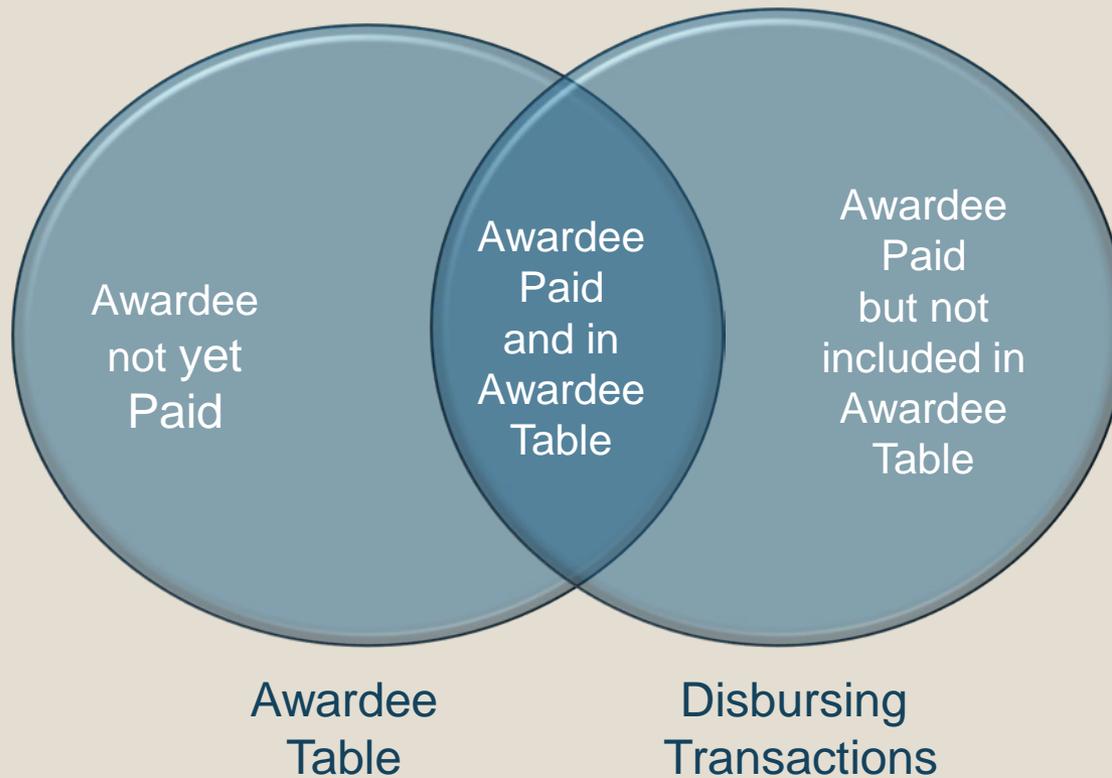
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# Data Analysis: Database Comparisons

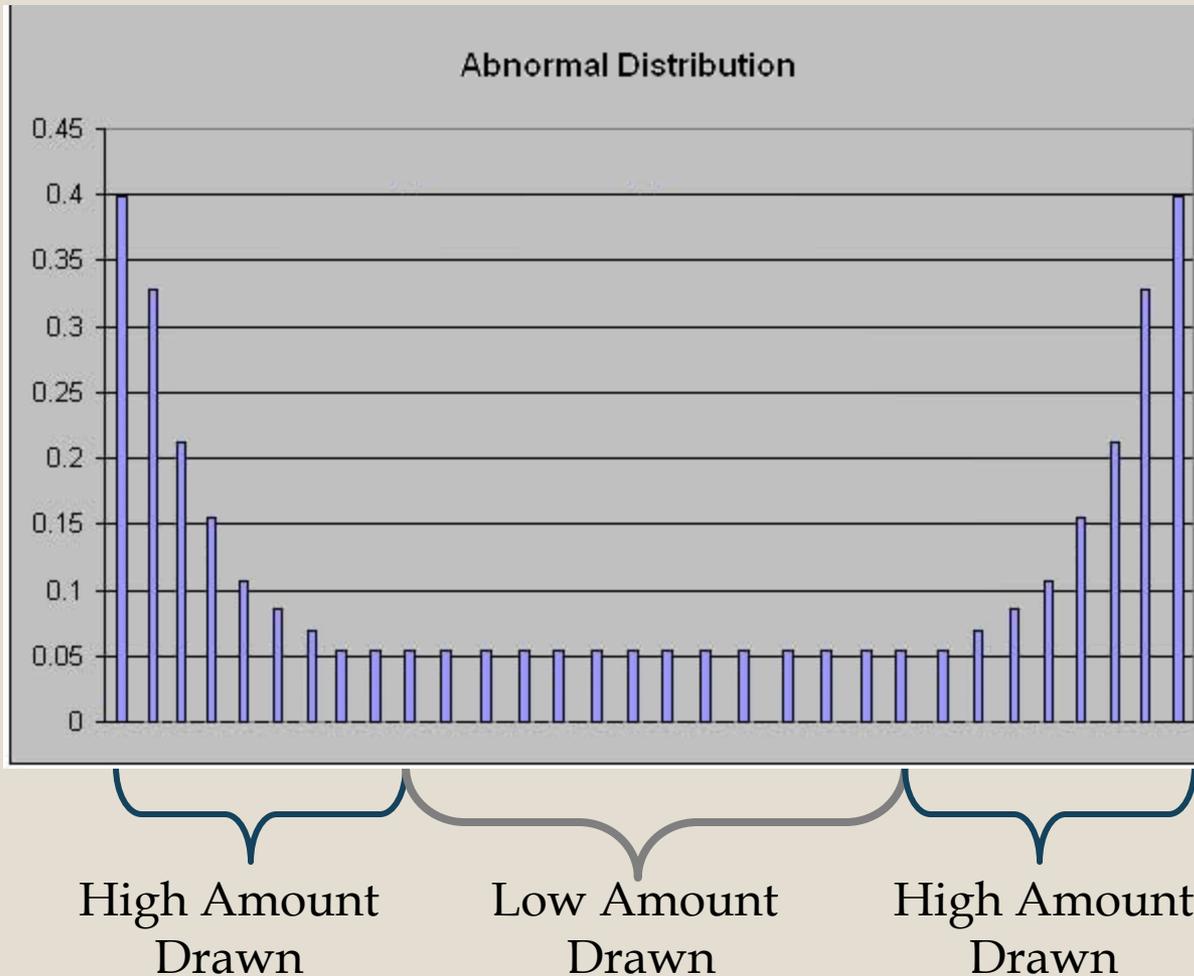
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# Focus on Anomalies/ Cash Draw Pattern

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# Cost Transfers Subsequent to Grant Expiration Date

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TRANSFERRED FROM: NSF GRANT ID	OBJECT DESCRIPTION	GRANT EXPIRATION DATE	LEDGER POST DATE	FINANCIAL AMOUNT	TRANSFERRED TO: NSF GRANT ID	FINANCIAL AMOUNT
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(8,259.67)	XXXXX60	8,259.67
XXXXX80	SUPPLIES & MATERIALS - OTHER	04/30/2009	06/30/2009	(3,240.26)	XXXXX60	3,240.26
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(777.31)	XXXXX60	777.31
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(677.27)	XXXXX60	677.27
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(545.00)	XXXXX60	545.00
XXXXX80	LAB INSTRUMENTS & SUPPLIES	04/30/2009	06/30/2009	(530.60)	XXXXX60	530.60
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(528.86)	XXXXX60	528.86
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(312.97)	XXXXX60	312.97
XXXXX80	LAB INSTRUMENTS & SUPPLIES	04/30/2009	06/30/2009	(274.36)	XXXXX60	274.36
XXXXX80	LAB INSTRUMENTS & SUPPLIES	04/30/2009	06/30/2009	(202.81)	XXXXX60	202.81
XXXXX80	LAB INSTRUMENTS & SUPPLIES	04/30/2009	06/30/2009	(197.17)	XXXXX60	197.17
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(180.00)	XXXXX60	180.00
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(164.42)	XXXXX60	164.42
XXXXX80	LAB INSTRUMENTS & SUPPLIES	04/30/2009	06/30/2009	(159.94)	XXXXX60	159.94
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(80.00)	XXXXX60	80.00
XXXXX80	SERVICES - DEPARTMENT RECHARGE	04/30/2009	06/30/2009	(40.00)	XXXXX60	40.00
XXXXX80	SUPPLIES & MATERIALS - OTHER	04/30/2009	06/30/2009	(30.07)	XXXXX60	30.07
XXXXX80	PERMITS-TAXES-FEES	04/30/2009	06/30/2009	(9.50)	XXXXX60	9.50
XXXXX80	OVERHEAD	04/30/2009	06/30/2009	(7,618.80)	XXXXX60	8,348.26
				<b>TOTAL</b>	<b>(23,829.01)</b>	<b>24,558.47</b>

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# Equipment Charges Incurred Immediately Before Grant Expiration Date

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GRANT ID	OBJECT DESCRIPTION	GRANT EXPIRATION DATE	TRANSACTION DATE	LEDGER POST DATE	FINANCIAL AMOUNT
XXXXX42	CONSTRUCTION AND ACQUISITION	09/30/2009	09/30/2009	10/06/2009	51,851.22
GRANT ID	OBJECT DESCRIPTION	GRANT EXPIRATION DATE	TRANSACTION DATE	LEDGER POST DATE	FINANCIAL AMOUNT
XXXXX27	INVENTORIAL EQUIPMENT	07/31/2010	06/04/2010	08/11/2010	31,621.56
GRANT ID	OBJECT DESCRIPTION	GRANT EXPIRATION DATE	TRANSACTION DATE	LEDGER POST DATE	FINANCIAL AMOUNT
XXXXX77	INVENTORIAL EQUIPMENT	08/31/2009	07/16/2009	09/10/2009	23,163.75
<b>TOTAL</b>					<b>106,636.53</b>



# Payroll Charges Incurred Subsequent to the Grant Expiration Date

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GRANT ID	OBJECT DESCRIPTION	GRANT EXPIRATION DATE	TRANSACTION DATE	LEDGER POST DATE	FINANCIAL AMOUNT
XXXXX31	WAGES - ACADEMIC	06/30/2008	07/31/2008	08/11/2008	15,726.79
XXXXX31	OVERHEAD-CONTRACT&GRANT	06/30/2008	07/31/2008	08/11/2008	8,288.49
XXXXX31	TUITION-FULL FEE REMISSION-RA	06/30/2008	07/31/2008	08/11/2008	4,485.63
XXXXX31	GRAD STUDENT HEALTH INSURANCE	06/30/2008	07/31/2008	08/11/2008	1,108.20
XXXXX31	LEAVE ACCRUAL	06/30/2008	07/31/2008	08/11/2008	646.88
XXXXX31	SOCIAL SECURITY REGENTS CONTR	06/30/2008	07/31/2008	08/11/2008	434.53
XXXXX31	OE-EMPLOYER UC OPEB CONTRIB-UC	06/30/2008	07/31/2008	08/11/2008	216.56
XXXXX31	WORKER COMPENSATION INSURANCE	06/30/2008	07/31/2008	08/11/2008	160.43
XXXXX31	MEDICARE	06/30/2008	07/31/2008	08/11/2008	101.62
XXXXX31	EMPLOYEE SUPPORT PROGRAM	06/30/2008	07/31/2008	08/11/2008	77.66
XXXXX31	UNEMPLOYMENT INSURANCE	06/30/2008	07/31/2008	08/11/2008	46.32
XXXXX31	GRAD STUDENT PARTIAL FEE REM	06/30/2008	07/31/2008	08/11/2008	21.22
XXXXX31	NON-INDUSTRIAL DISABILITY CONT	06/30/2008	07/31/2008	08/11/2008	12.26
XXXXX31	OE-BENEFITS ADMIN ASSESSMENT	06/30/2008	07/31/2008	08/11/2008	11.22
XXXXX31	SPECIAL LIFE INS CONTRIBUTION	06/30/2008	07/31/2008	08/11/2008	8.68
XXXXX31	REGENTS HEALTH INS CONTR	06/30/2008	07/31/2008	08/11/2008	(14.72)
<b>TOTAL</b>					<b>31,331.77</b>



# Forensic Audit Framework

## Finding Grant Fraud Risk

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- **Set Objectives and Define Universe**
- **Map out End-to-End Process**
  - Identify systems, key processes and controls
- **Obtain Transaction-Level Data**
- **Build Targeted Business Rules and Run Against Data**
  - PI/Institution patterns over time
  - Risk factors
- **Examine Anomalies**



# End to End Process for Grant Oversight

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SOLICITATIONS  
PROPOSALS  
PRE-AWARD  
REVIEW  
AWARD  
CASH  
REQUEST  
PAY/  
ENTITLEMENT  
CASH  
DISBURSEMENTS  
POST AWARD  
AWARD  
CLOSE-OUT

## PRE-AWARD RISKS

- Funding Over Time
- Conflict of Interest
- False Statements
- False Certifications
- Duplicate Funding
- Inflated Budgets
- Candidate  
Suspended/Debarred

## ACTIVE AWARD RISKS

- Unallowable, Unallocable, Unreasonable Costs
- Inadequate Documentation
- General Ledger Differs from Draw Amount
- Burn Rate
- No /Late/Inadequate Reports
- Sub-awards, Consultants, Contracts
- Duplicate Payments
- Excess Cash on Hand/Cost transfers
- Unreported Program Income

## AWARD END RISKS

- No /Late Final Reports
- Cost Transfers
- Spend-out
- Financial Adjustments
- Unmet Cost Share

DATA ANALYSIS

# Look at Red Flag Areas

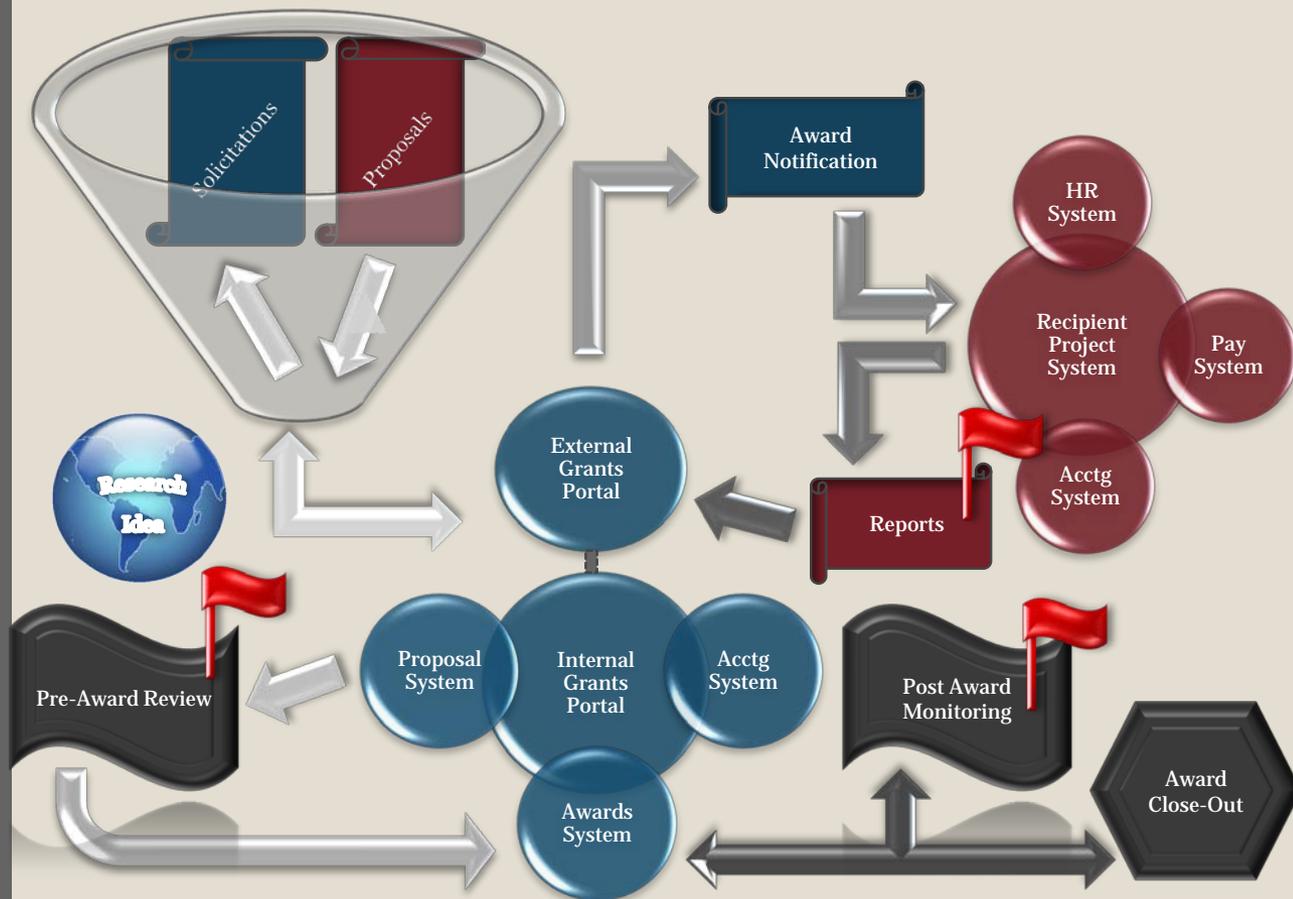
The more red flags, the higher the risk.



The less red flags, the lower the risk.



## Use Data Analysis to Identify Anomalies Breaks in Trends and Outliers are Potential Fraud Indicators





# Transaction Level Fraud Indicators: Grantee Data

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- **Cost Transfers to Other Projects or Contracts**
- **Multiple Payments of Same Invoice**
- **Excessive Costs/Large Budget Reallocations**
- **Multiple Adjusting Entries, Spendout at End of Grant**
- **Unallowable Charges, Charges after Expiration**



# Payroll Fraud Indicators: Grantee Data

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- **Payments after Grant Expiration**
- **Multiple Labor Categories for Same Employee**
- **Timesheets with Signature Differences**
- **Employee Background, Experience, or Education Does Not Meet Requirements**
- **Fictitious Employees, Such as Contractor's Relatives**



# Forensic Audit Results

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**\$1.5 Billion Dollars (US) Recovered Over 20 Years**

## **Fraud Results (examples)**

- **\$177M (US) Pell Grants (College loans)**
- **\$ 30M (US) Student Loan Forgiveness**
- **\$122M (US) Purchase Card Fraud (one agency)**
  - **100 Prosecutions**
  - **250 Disciplinary Actions**



# NSF Case Study: School District Trust is Not a Control

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- **Grantee Draws \$2.1 Million in 3 Months**
  - Usual drawdown pattern: \$250,000 quarterly
  - Awardee cannot provide documentation
- **Total NSF Funds Awarded: \$23.1 Million**
  - Audit Universe 2008: \$13.1 Million
  - OIG Questioned Costs: \$ 4.2 Million
  - NSF sustained: \$ 3.3 Million



# Future of Cost Records

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- **Electronic Invoices and Receipts**
- **Debit Cards**
  - **Funding Agency Can Access Transaction Charges**
- **Continuous Monitoring**
  - **Grantee Performs**
  - **Agency Performs**



# Additional Information

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## Questions?

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