Asset Liability Management Process

Asset Allocation
(Risk Assumptions and Capital Market Assumptions)
Comprehensive analysis coordinated with review of actuarial assumptions

Actuarial Assumptions
(Economic and Demographic Assumptions and Review of Trust Fund Status)
Currently reviewed every four years per board policy

Sustainable Funding
• Fiduciary duty
• Constitutional authority
• Statutory requirement
• Professional standards
ALM Model Building Blocks

- Starting Point
  - Assets and Liabilities at June 30, 2016
  - Benefit payments for FY 2016-2017
  - Contributions for FY 2016-2017
  - Investment return for FY 2016-17 (11.2%)

- Liability Projection for 30 Years
  - Liabilities projected for each discount rate
  - Open Group (New members join in future years)

- Asset Projection for 30 Years
  - For each discount rate 5,000 investment return paths over 30 years are randomly simulated

Economic Assumptions

- Price Inflation
- Wage Inflation
- Payroll Growth
- Long-term Expected Return on Assets
Demographic Assumptions

- Workforce Demographics
- Disability Retirement
- Mortality

Male and Female Life Expectancy at Age 55 for Healthy Recipients
Financial Highlights

Current Value $345 billion*

| 11.20% | 8.83% | 4.39% | 6.60% | 8.40% |
| 2016/17 Portfolio Return | 5-yr Annualized Return | 10-yr Annualized Return | 20-yr Annualized Return | Annualized Return Since 1988 |

* As of 11/28/2017

Interest Rates vs CalPERS Investment Mix
Wilshire Forecasts through Time

Return prospects have been declining for decades, following the downward trend in interest rates

Change in CalPERS Market Forecasts

- 2014 ALM Assumptions
- Current Environment (December 2016)
- Assumed Rate of Return
Candidate Portfolios

Asset Allocation of Preliminary Candidate Portfolios

<table>
<thead>
<tr>
<th>Asset Class Component</th>
<th>Candidate A</th>
<th>Candidate B</th>
<th>Candidate C</th>
<th>Candidate D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Equity</td>
<td>34%</td>
<td>42%</td>
<td>50%</td>
<td>59%</td>
</tr>
<tr>
<td>Private Equity</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Fixed Income</td>
<td>44%</td>
<td>36%</td>
<td>28%</td>
<td>19%</td>
</tr>
<tr>
<td>Real Assets</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Infrastructure/Forestland</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Inflation Assets</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Liquidity</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Expected Compound Return</td>
<td>5.6%</td>
<td>5.8%</td>
<td>6.1%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Long-term Expected Return</td>
<td>7.3%</td>
<td>8.2%</td>
<td>8.1%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Blended Return</td>
<td>6.50%</td>
<td>6.75%</td>
<td>7.00%</td>
<td>7.23%</td>
</tr>
<tr>
<td>Expected Volatility</td>
<td>9.1%</td>
<td>10.2%</td>
<td>11.4%</td>
<td>12.8%</td>
</tr>
<tr>
<td>Cash Yield</td>
<td>3.1%</td>
<td>3.0%</td>
<td>2.9%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

*With the 2023 Capital Market Assumptions, the Current Policy Portfolio has an expected compound return of 7.3% for years 1 through 20. Expected compound return of 8.1% for the long-term (i.e., greater than 10) blended return of 7.5%.
* Expected return is the weighted average of return of years 1 through 10 and the long-term minus 5% for risk off

Candidate Portfolios - Efficient Frontier

Expected Return (10 Years) vs. Expected Volatility

- Candidate A
- Candidate B
- Candidate C
- Candidate D
- 2013 ALM Policy
- Current Allocation
- Interim Policy
Scenario Analysis (Global Financial Crisis & Recovery)

Total Fund Cash Flows are Improving
Historic & Projected PERF Cash Flow Analysis
### Contribution, Benefit Payments and Investment Income

2013 and Today

![Chart showing contribution, benefit payments, and investment income trends over fiscal years 2013 and 2017.](chart.png)

**Discount Rate Determination**

Based on Blended CMA rates and projected Cash Flows

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Discount Rate</th>
<th>Portfolio Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6.50%</td>
<td>9.1%</td>
</tr>
<tr>
<td>B</td>
<td>6.75%</td>
<td>10.2%</td>
</tr>
<tr>
<td>C</td>
<td>7.00%</td>
<td>11.4%</td>
</tr>
<tr>
<td>D</td>
<td>7.25%</td>
<td>12.8%</td>
</tr>
</tbody>
</table>

1. Does not include any provision for adverse deviation.
Public Agency Miscellaneous

Measure 1:
Probability of PERS funded status falling below 50% or 60% over the next 30 years

Measure 2:
Probability of high employer contribution rates over 30% / 35% / 40%

Measure 3:
Probability of sharp increases in annual employer contribution rates over 3%

Average Employer Contribution Rates Over Next 30 Years

Percentage of Payroll

PA Miscellaneous

A: 22.4%, B: 20.0%, C: 18.0%, D: 16.6%

PA Safety

A: 42.7%, B: 43.7%, C: 40.3%, D: 36.9%
Market Valuations

Valuation Metrics vs. Historical Range – A Measure of Risk (as of September 2017)

Current Actuarial Amortization Policy
Proposed Actuarial Amortization Policy

<table>
<thead>
<tr>
<th>Driver</th>
<th>(Gain)/Loss</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Investment</td>
<td>Non-Investment</td>
</tr>
<tr>
<td>Amortization Period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Agencies</td>
<td>20 Years</td>
<td>20 Years</td>
</tr>
<tr>
<td>Inactive Agencies</td>
<td>Closed Period (15 years or less)</td>
<td>Closed Period (15 years or less)</td>
</tr>
<tr>
<td>Escalation Rate</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Ramp Up</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Ramp Down</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Investment Gain or Loss ($1,000,000 Loss)

![Graph showing UAL Balance and Annual Payments for Current Policy and Proposed Policy](graph.png)
### 2017-18 ALM Timeline

- **November 13**
  - Board of Administration Meeting
  - Asset Liability Management Workshop

- **November 14**
  - Finance & Administration Committee
  - Review Actuarial Assumptions and Methods

- **December 18**
  - Investment Committee
  - Adopt Strategic Asset Allocation for Ratifications by the Board

- **December 19**
  - Finance & Administration Committee
  - Adopt Actuarial Assumptions and Methods for Ratifications by the Board
  - Adopt Discount Rate for Ratifications by the Board

- **December 20**
  - Board of Administration Meeting
  - Select Strategic Policy Portfolio

- **February 12**
  - Investment Committee
  - Review Transition and Implementation Plan
  - Review Amendments to Statement of Investment Policy

- **February 14**
  - Board of Administration Meeting
  - Select Strategic Policy Portfolio

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Appendix
2017 Capital Market Assumptions

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Arithmetic Return</th>
<th>Compound Return</th>
<th>Volatility (Std. Dev.)</th>
<th>Correlation</th>
<th>Floor</th>
<th>Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Global Equity</td>
<td>Private Equity</td>
<td>Fixed Income</td>
</tr>
<tr>
<td>Global Equity</td>
<td>8.14%</td>
<td>6.80%</td>
<td>17.00%</td>
<td>1.00</td>
<td>0.81</td>
<td>0.01</td>
</tr>
<tr>
<td>Private Equity</td>
<td>11.26%</td>
<td>8.30%</td>
<td>25.50%</td>
<td>0.81</td>
<td>1.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Fixed Income</td>
<td>3.21%</td>
<td>3.00%</td>
<td>6.58%</td>
<td>0.01</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Real Assets</td>
<td>6.49%</td>
<td>5.75%</td>
<td>12.55%</td>
<td>0.59</td>
<td>0.48</td>
<td>0.09</td>
</tr>
<tr>
<td>Inflation Asset</td>
<td>3.08%</td>
<td>2.77%</td>
<td>8.00%</td>
<td>0.39</td>
<td>0.33</td>
<td>0.40</td>
</tr>
<tr>
<td>Liquidity</td>
<td>2.00%</td>
<td>2.00%</td>
<td>1.00%</td>
<td>0.00</td>
<td>0.00</td>
<td>0.31</td>
</tr>
</tbody>
</table>

U.S. Inflation Assumption: 2.00%