



# A Strategic Balanced Scorecard For Publicly Funded Science and Technology Programs

Presentation at  
The Atlanta Conference on S&T Policy  
May 18-19, 2006

Gretchen B. Jordan

Sandia National Laboratories

[gbjorda@sandia.gov](mailto:gbjorda@sandia.gov), 202-314-3040

Jerald Hage and Jonathan Mote

Center for Innovation at the University of Maryland

Parts of work presented here was completed for the U.S. DOE Office of Science by Sandia National Laboratories, Albuquerque, New Mexico, USA under Contract DE-AC04-94AL8500 and for the Office of Research Applications in the National Oceanic and Atmospheric Administration. Sandia is operated by Sandia Corporation, a subsidiary of Lockheed Martin Corporation. Opinions expressed are solely those of the authors.

# Motivation for better indicators for S&T organizations

- Increasing interest in stimulating scientific advance and innovation
- Increasing requirements to demonstrate value of organizations and portfolios
- Current knowledge of how to stimulate innovation and current performance measurement systems fall short

# Why a Balanced Scorecard based on organizational strategy?

- **STRATEGIC** - Clarifies and communicates the strategy
  - Technical focus and performance
  - Focused management initiatives
- **BALANCED** - Avoids over emphasizing one perspective on what to value and measure
- **SCORECARD** - Identifies key indicators linked to strategy
  - Technical performance as expected?
  - If not, other indicators show bottlenecks

# Strategy Map Balanced Scorecard has to be modified for publicly funded S&T

## Private - Product

## Public – S&T

**Financial Perspective**

*Mission*  
**Perspective**

**Customer Perspective**

**Internal Process Perspective**

**Learning & Growth Perspective**

SHAREholder Value		<i>STAKEholder Values</i>	
Revenue Growth	Productivity	<i>Mission problems solved</i>	<i>Innovation speed &amp; cost</i>
Product leadership	Operational excellence	<i>S&amp;T leadership, deliverables</i>	<i>S&amp;T excellence, relevance</i>
Innovation	Customer Management Operations	<i>Technical progress</i>	<i>S&amp;T management Operations</i>
Employee, <i>Knowledge</i> & Technology Base		<i>Culture/ Research Environment</i>	

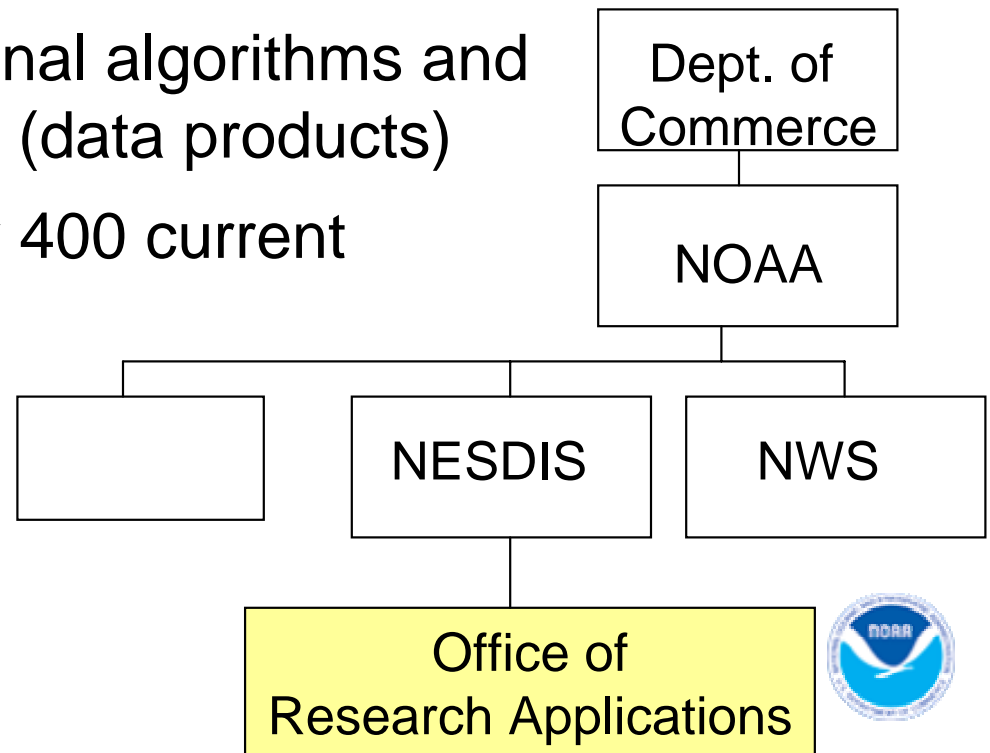
External Influences

# Developing a strategic balanced scorecard

- Gather information about the program from documents and interviews
- Begin a rough draft that simplifies the complexity, but uses their terminology
- Work with researchers to define real time measures of technical progress and seek to link these to mission
- Iterate to refine/define draft
- Seek verification from levels within the organization

# Our Example - NOAA's Office of Research Applications (ORA)

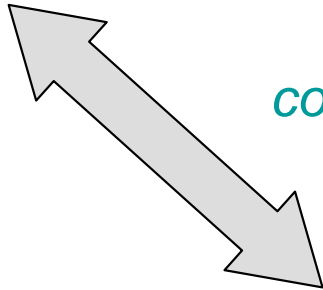
- About 70 scientists focused on atmospheric science
- Three divisions that encompass satellite meteorology, oceanography, climatology, and cooperative research with academic institutions
- Chartered to develop operational algorithms and applications using satellite data (data products)
- Also provide support to nearly 400 current satellite-derived products



# Basic activities of ORA research projects

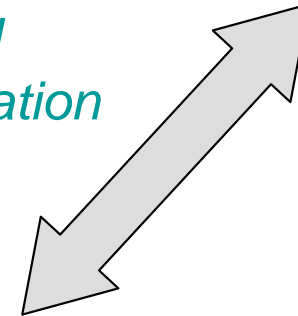
**Impact** on design changes in products and models

*Communication and coordination*



**Impact** on design changes in satellites and instruments

*Communication and coordination*



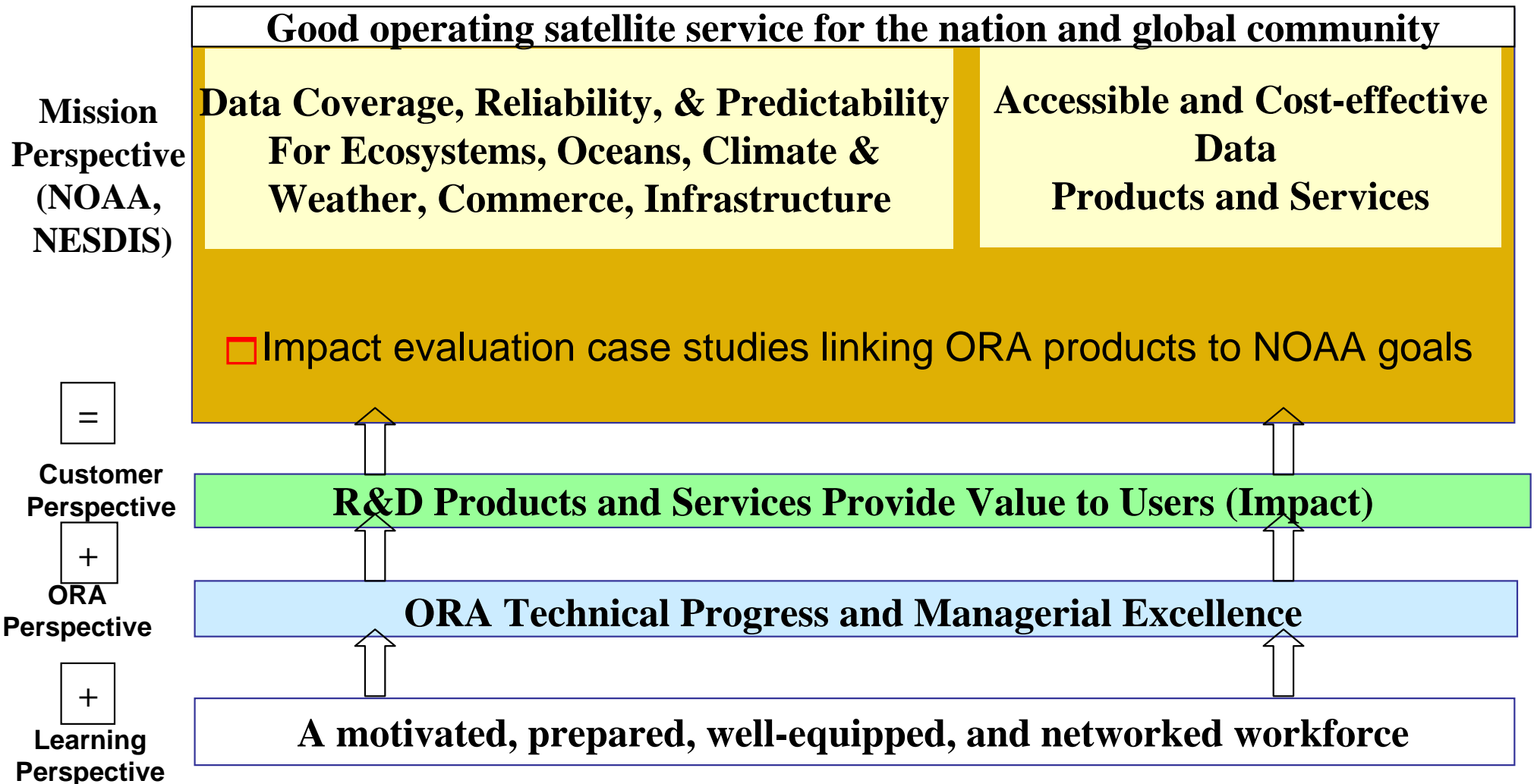
## **Quality Control activities**

- Calibration
- Validation
- Correction of algorithms
- Correction of time series

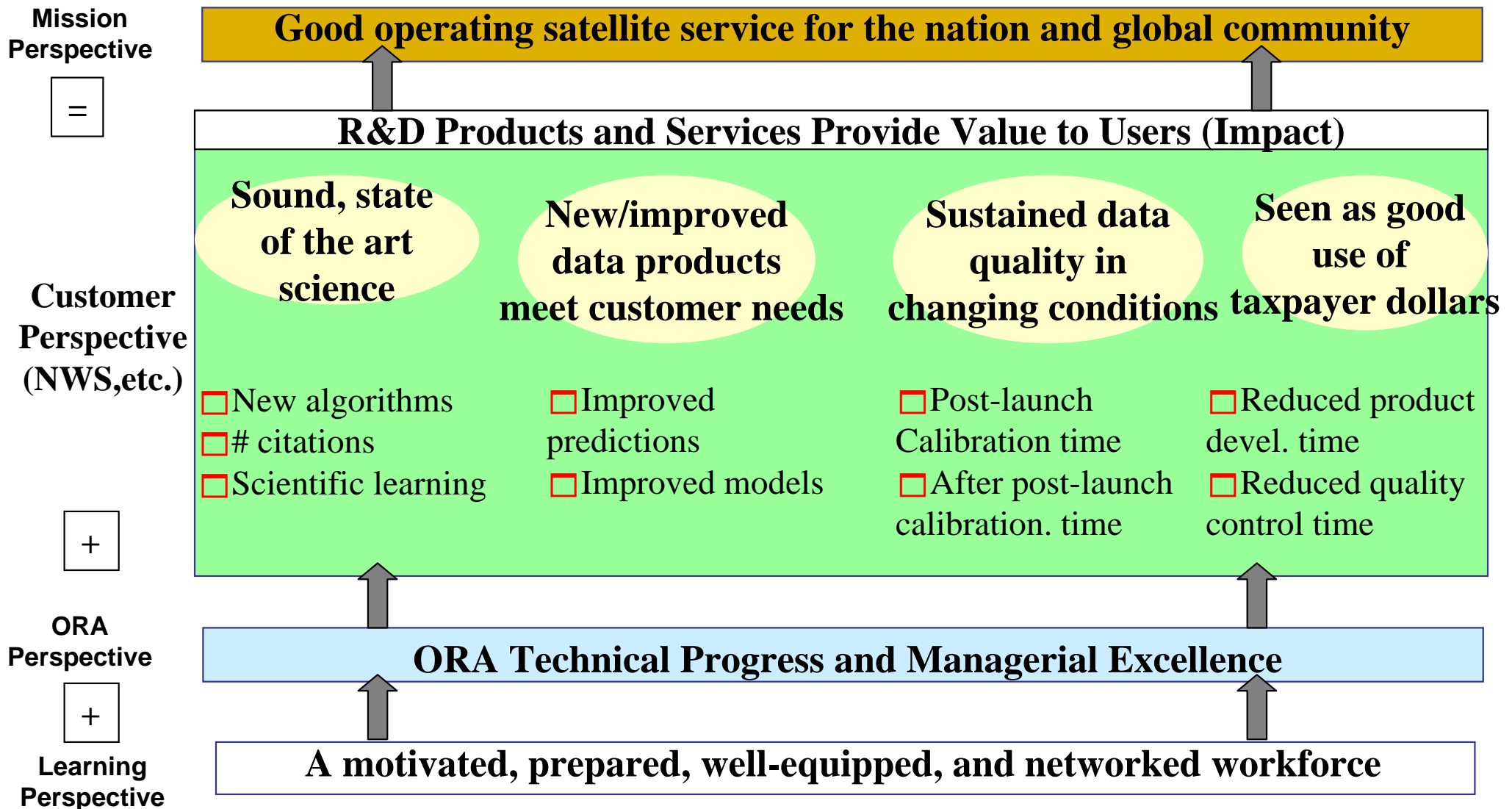
## **Research Activities**

- Causes of errors in calibration or algorithms
- New methods
- New products

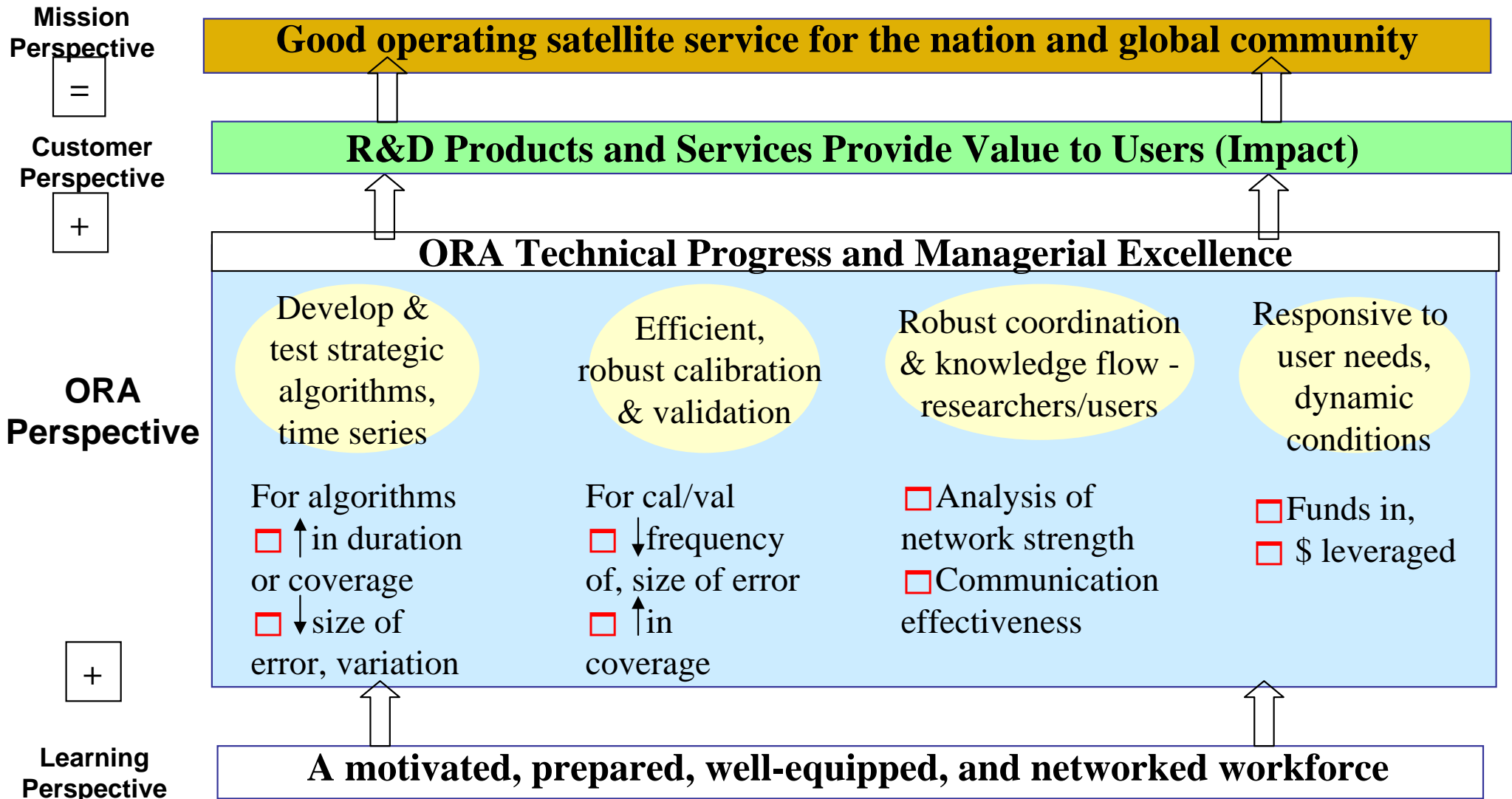
# The organization's contribution to agency mission and multiple stakeholders



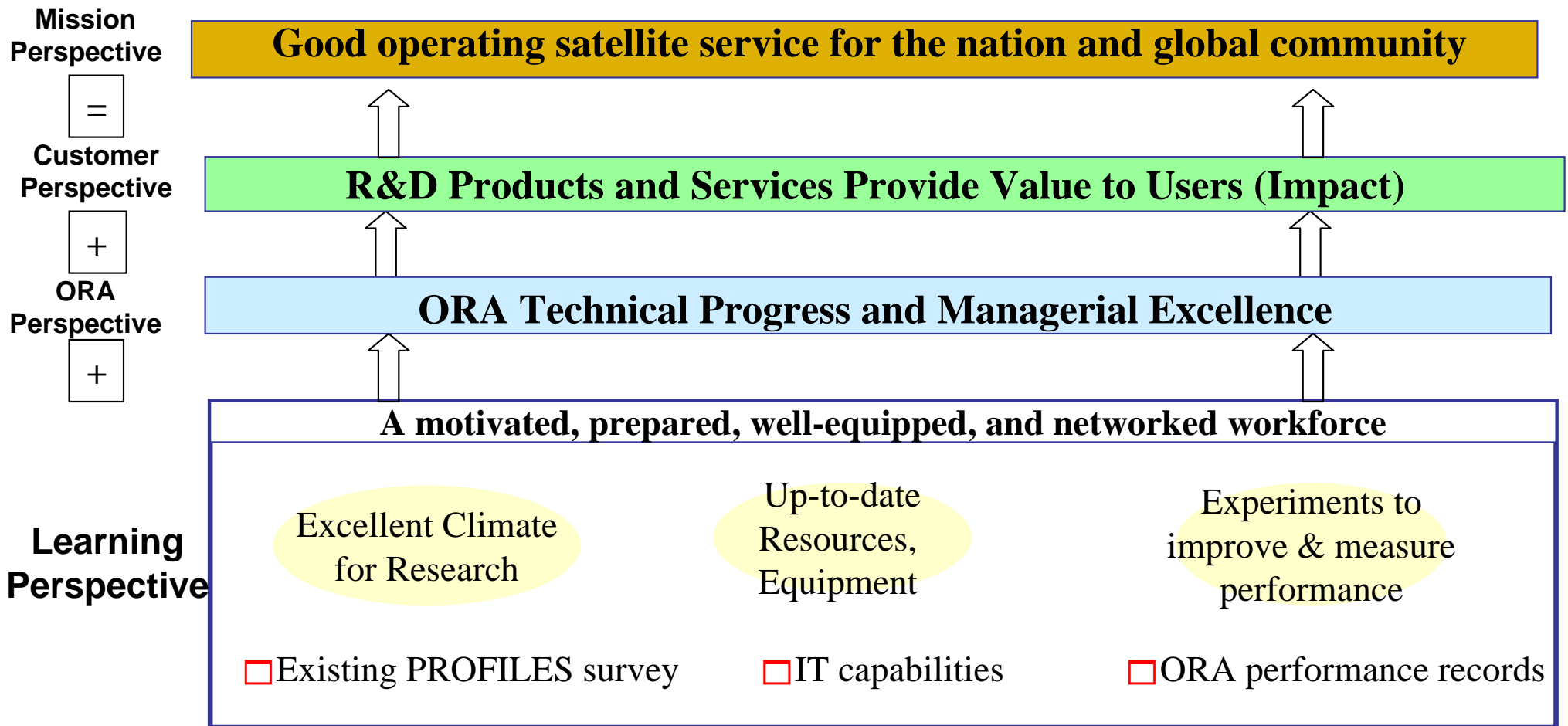
# Delivering value to customers at the organizational level



# S&T technical progress and managerial excellence at project level

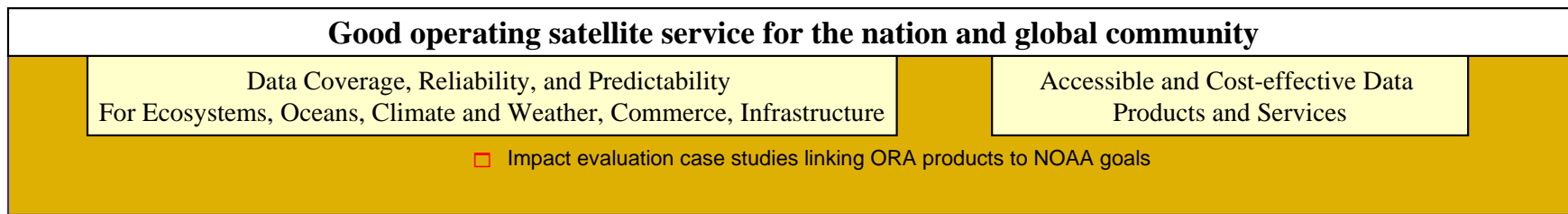


# The foundation – matching resources and management practices to strategies



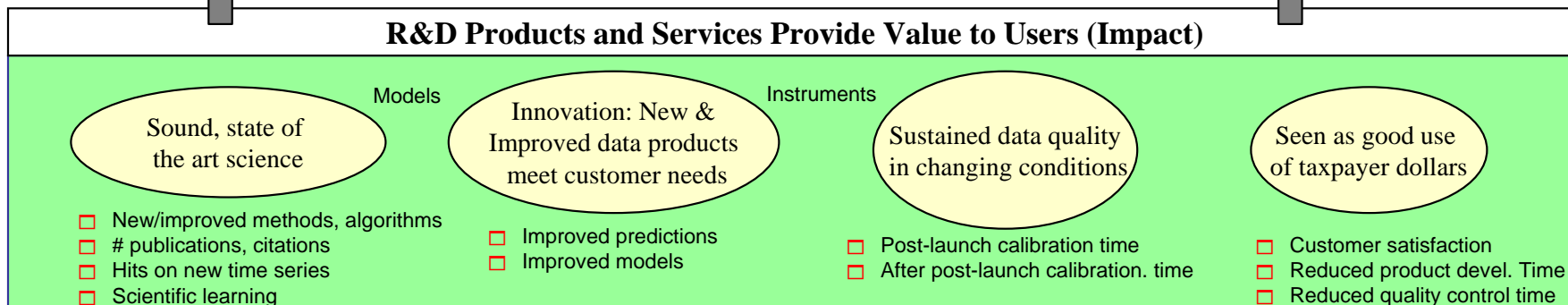
**Mission Perspective (NOAA, NESDIS)**

=



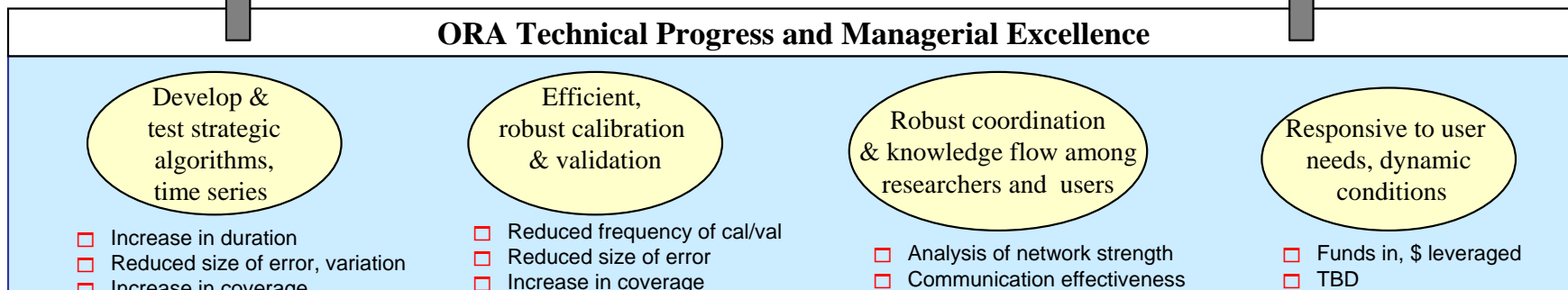
**Customer Perspective (NWS, etc.)**

+

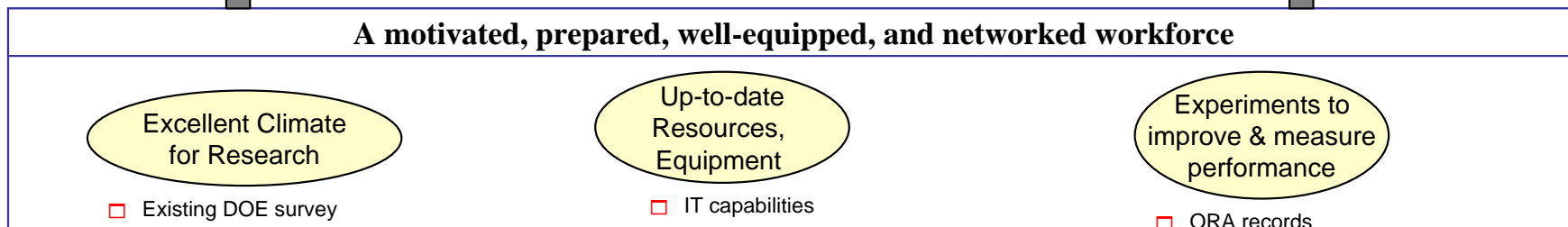


**ORA Perspective**

+



**ORA Learning Perspective**



# We have a theory-based diagnostic tool looking at management practices in the research environment

## *Human Resource Development*

**Value the Individual**

**Build Teams and Teamwork**

**Commit to Employee Growth**

---

## *Support Systems*

**Provide Capital, Knowledge Resources**

**Ensure Good Technical Management**

**Insist on Efficient, Low Burden Systems**

## *Innovativeness*

**Encourage Risk Taking**

**Integrate Ideas**

**Encourage Change/Critical Thinking**

---

## *Setting Goals*

**Clearly Define Goals & Strategies**

**Plan and Execute Well**

**Build Strategic Relationships**

## And are working on indicators of technical progress that...

- Make a S&T strategic balanced scorecard feasible
- Capture specifics of advances in a way that links progress to higher level objectives
- Capture multiple attributes of progress since research is complex with multiple constraints
- Can be generalized so progress of similar projects or portfolios can be compared or aggregated
- Measure current performance in real time (at least annually) and are continuous so can track across time
- Complement existing measures

# Proposed general measures of progress

- For Technology (like new product development): focus on the functionality of new products, such as precision, speed, size, reliability
- For Scientific Advance – three primary areas:
  - Analytical - characterization of a particular phenomena (Precision of prediction)
  - Descriptive - discovery and the initial identification of patterns (New patterns or hypotheses)
  - Control – mastery of phenomena
- Also looking for a measure of “Learning” on the way to any of these progress markers
- For all measures, we suggest adding assessment of two dimensions of the radicalness of that progress – Degree of advance and Scope of advance

# Summary and Conclusions

- Balanced scorecards that reflect strategy and multiple stakeholders definitions of “success” provide better information for policy makers and managers than ad hoc sets of indicators.
- Linking performance to management practice and theory is key.
- Generalizable, real time measures of S&T progress linked to organizational and mission goals are key.
- Our research is making progress on all these fronts.