

---

# ***MAKING PROGRESS ON GREENER SKIES***

***Aviation and the Environment  
University of California, Berkeley***

***March 12, 2003***

---

**Frank Berardino, President  
GRA, Incorporated**



115 West Avenue • Jenkintown, PA 19046 • USA

☎ 215-884-7500 • 📠 215-884-1385

✉ [frankb@gra-inc.com](mailto:frankb@gra-inc.com)

# **GREENER SKIES: ENVIRONMENTAL PROBLEMS ARE CLASSIC EXTERNALITIES NOT WELL ADDRESSED WITHOUT GOVERNMENT INTERVENTION**

- Airline markets worldwide have become more competitive
  - Few carriers have incentives to unilaterally address environmental problems directly
  - In many cases, noise- and emission-reducing technologies are “counter productive” and may conflict with other environmental objectives



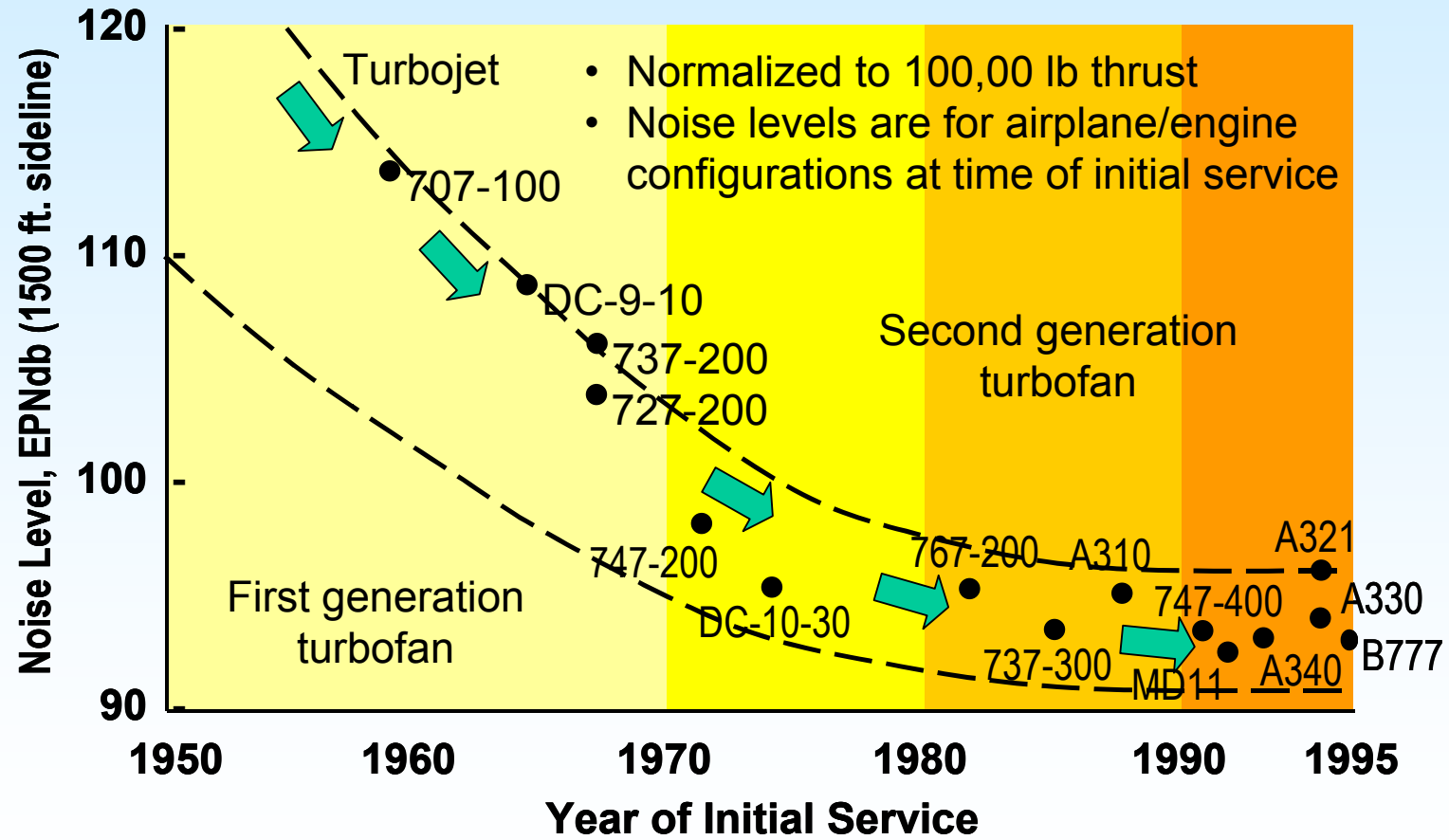
# GOVERNMENT TRADITIONAL ROLES

- 1) Assist manufacturers in developing new technologies
  - Private sector under-invests
  
- 2) Mandate reductions in noise and emissions
  - Traditionally based on technological progress **and** re-equipment cycles
  
  - Grass roots efforts affect outcomes—stymie airport expansions; change political outcomes



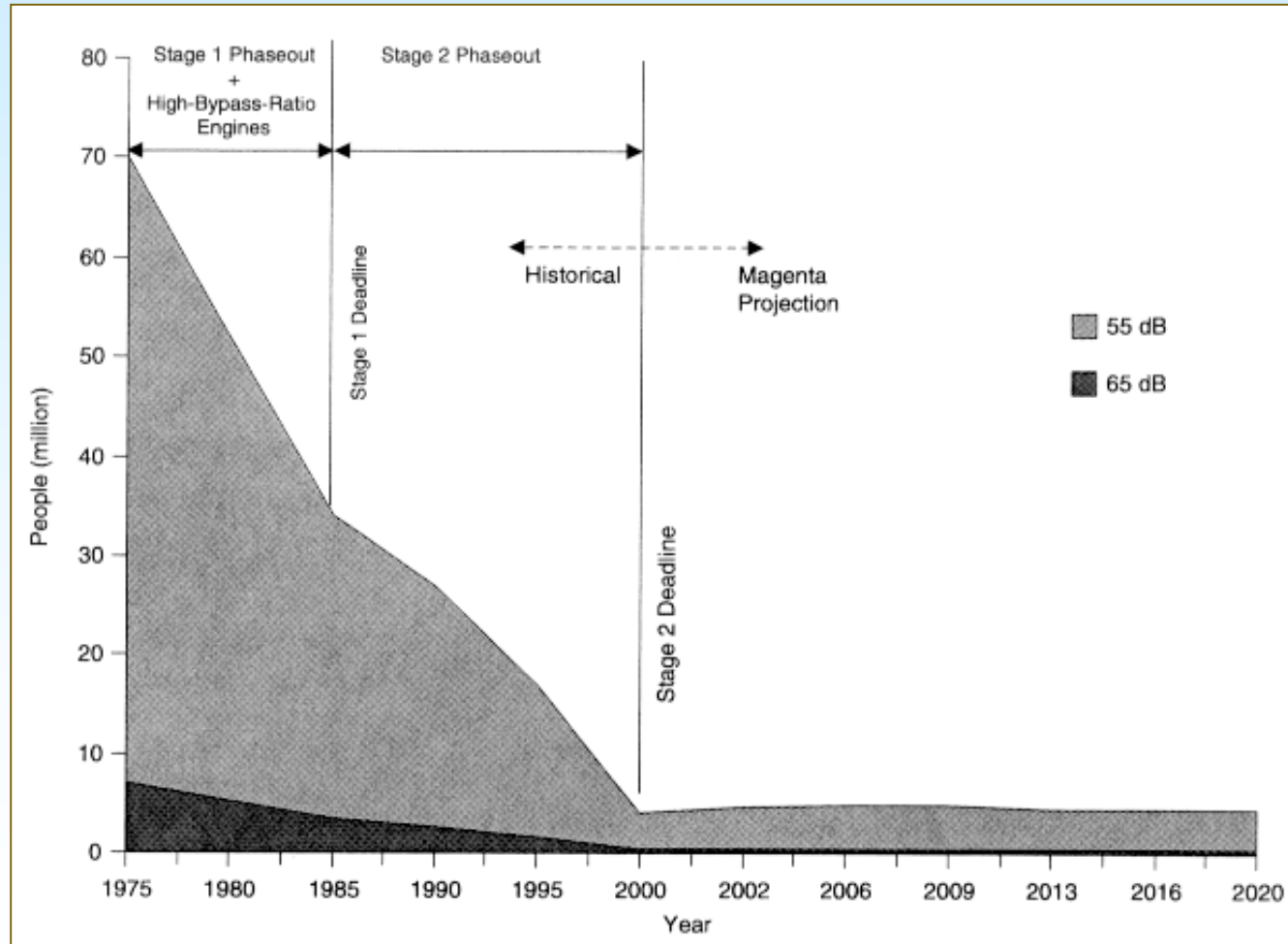
# A GREAT DEAL OF PROGRESS HAS BEEN MADE ON NOISE

## Progress in Noise Reduction



# PROGRESS ON NOISE IS PARTICULARLY NOTEWORTHY WHEN MEASURED BY AFFECTED POPULATION

Estimated Trends in Number of People Affected by Aircraft Noise in the U.S.  
(Number of People Within 65 dB and 55 dB DNL as a Function of Time)

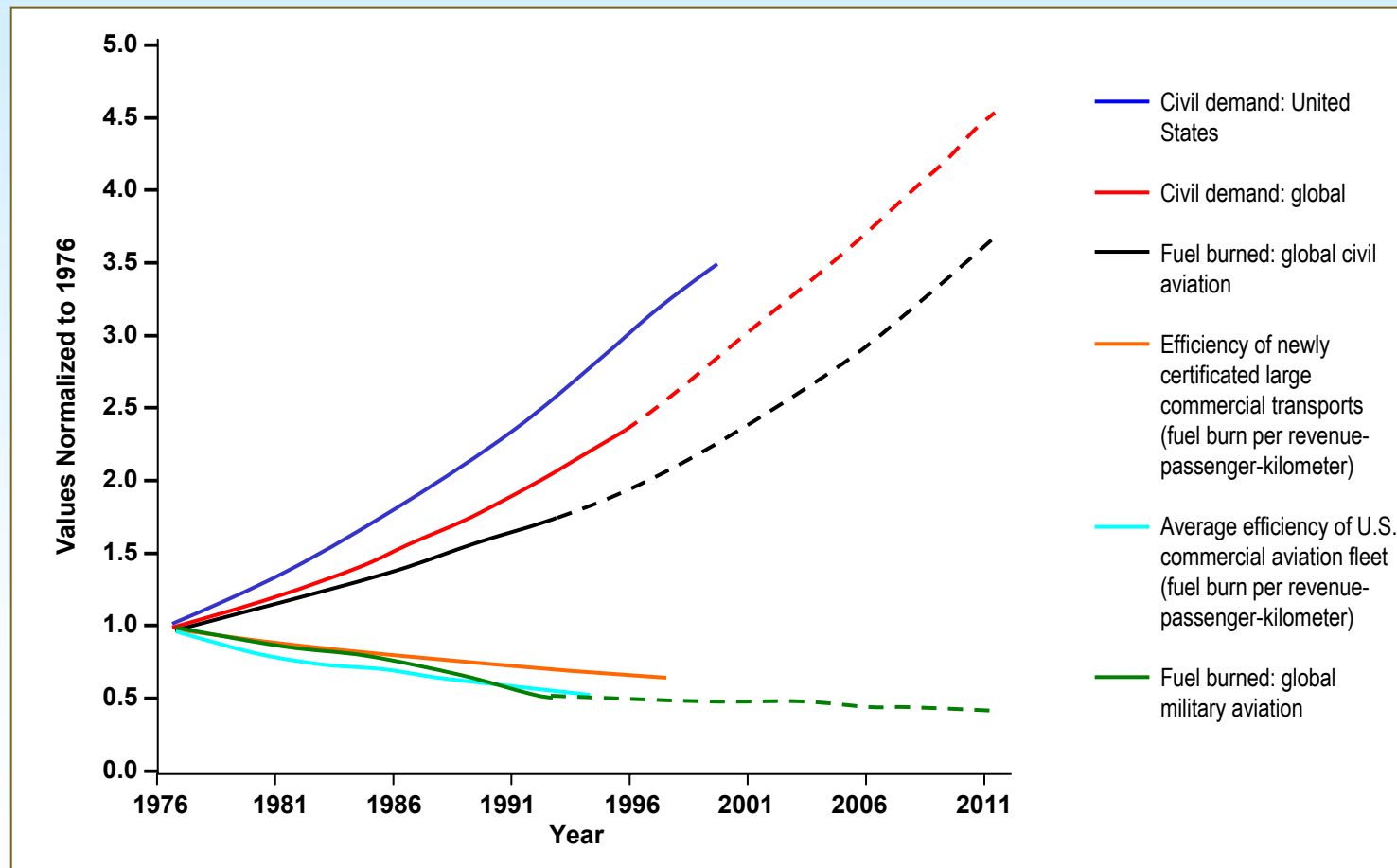


Source: Lukachko and Waitz, 2001



# FUEL EFFICIENCY HAS CONTRIBUTED SIGNIFICANTLY TO REDUCTIONS IN EMISSIONS

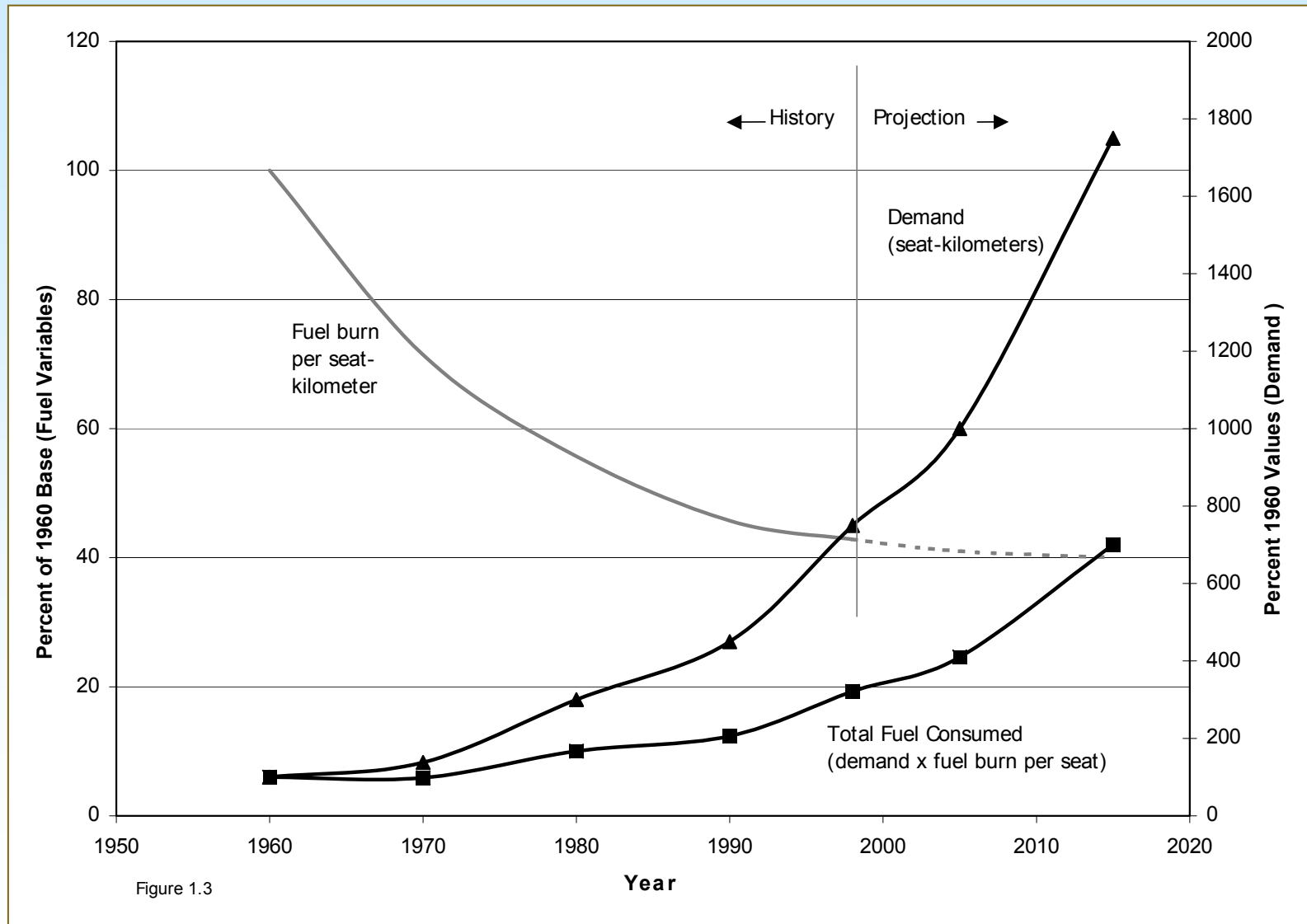
## Decadal Trends for Demand, Efficiency, and Fuel Usage Dashed Portions of Curves are Projections



Source: Lukachko and Waitz, 2001



# BUT SUSTAINING BOTH GROWTH AND PROGRESS ON EMISSIONS WILL BE CHALLENGING

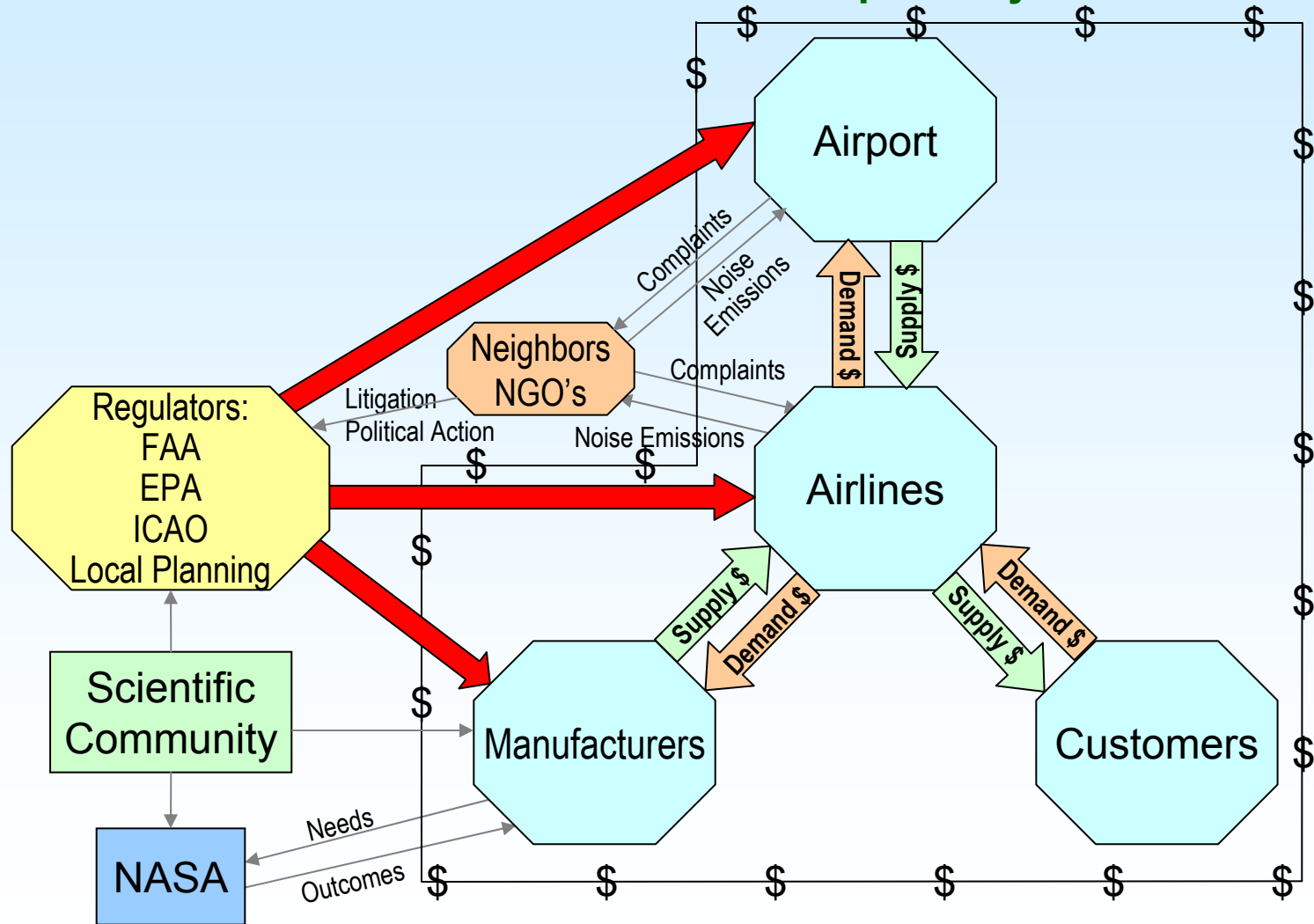


Source: Lukachko and Waitz, 2001



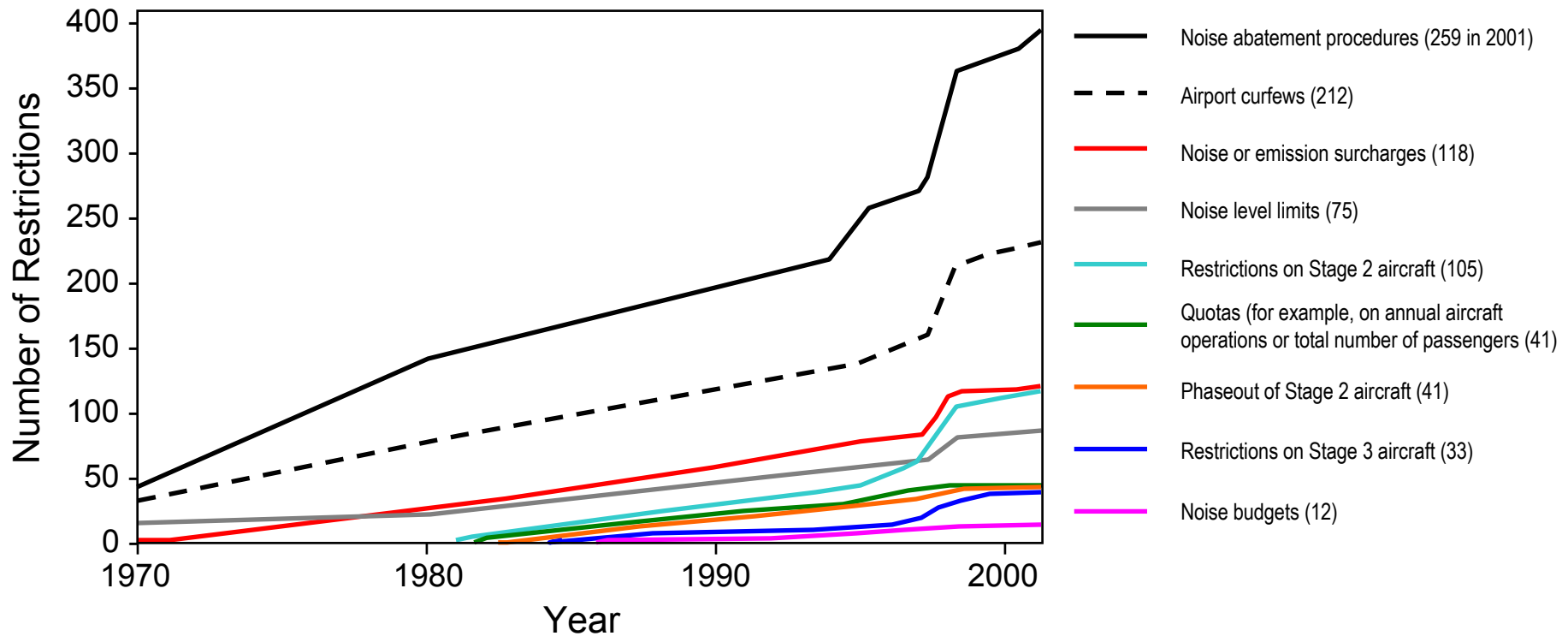
# ILLUSTRATION OF THE “ENVIRONMENTAL DEAL”

## Market and External Influences on Aviation Environmental Compatibility



# ONE OF THE THREATS TO THE AIRLINE INDUSTRY IS THE BALKANIZATION OF ENVIRONMENTAL REGULATIONS

## Trends in Aircraft Noise Regulation: Number of Airports Worldwide Imposing Various Constraints and Charges as a Function of Time

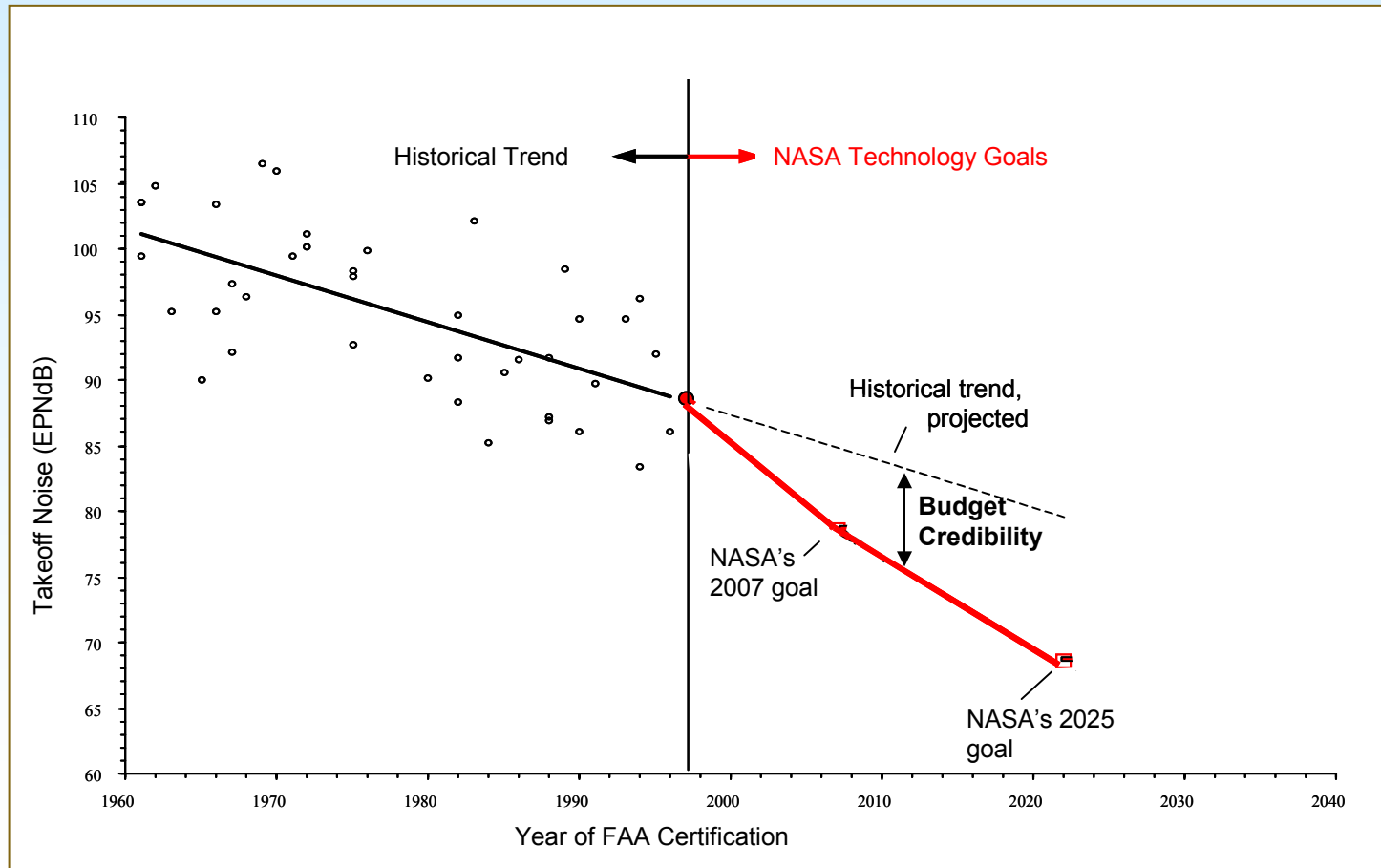


Source: Boeing, 2001



# ONE WAY TO SATISFY MORE "INTERESTED PARTIES" IS TO ACCELERATE TECHNOLOGICAL OPPORTUNITIES

Historical Trends in Aircraft Noise Compared with NASA's Noise Goals  
Centerline Takeoff Noise for Aircraft Certificated Since 1980 is Typically About 4 dB Louder Than Sideline Noise During Takeoff and About 8 dB Louder Than Approach Noise

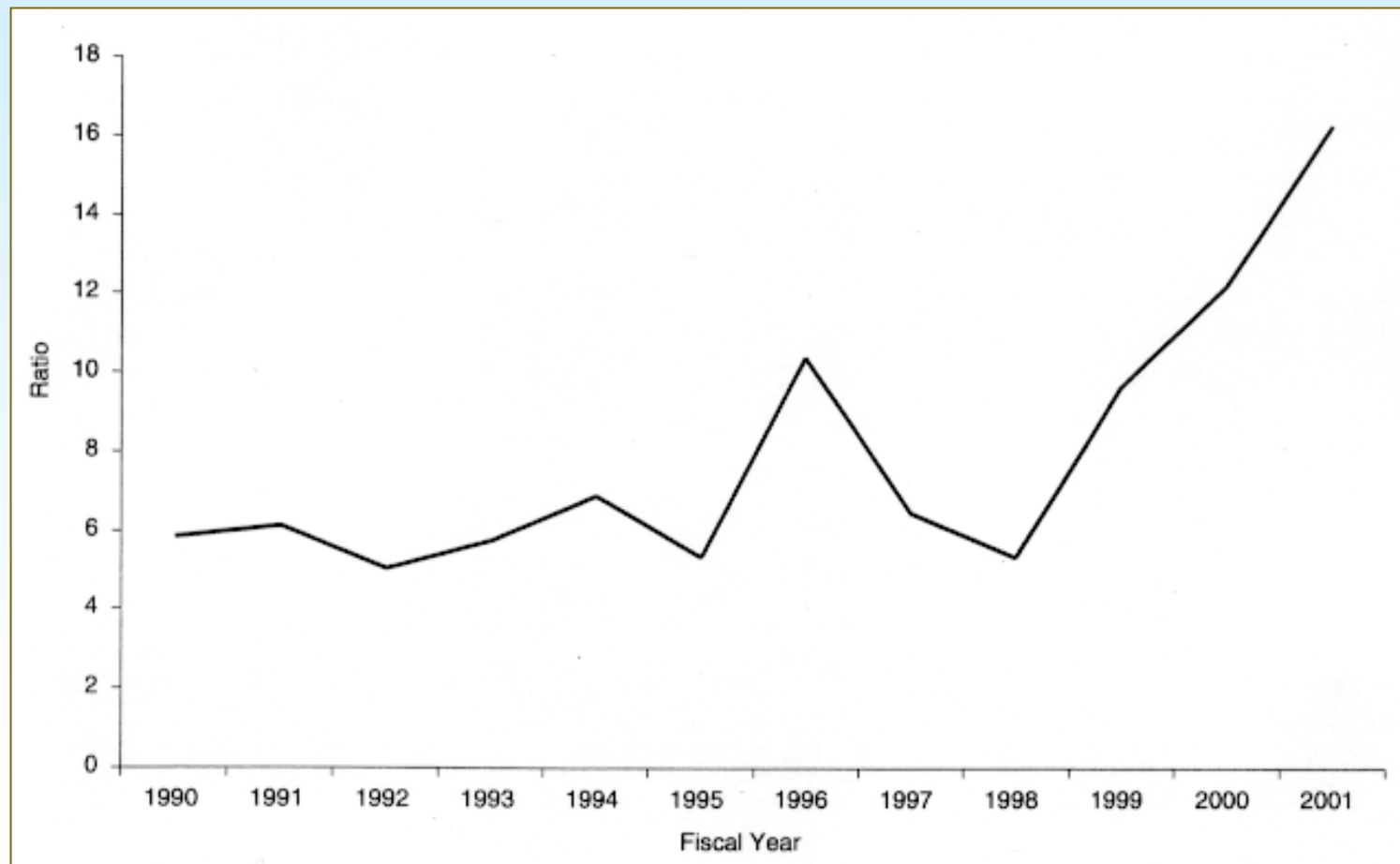


Source: Lukachko and Waitz, 2001



# THE RATIO OF FEDERAL FUNDS SPENT ON ABATEMENT VERSUS RESEARCH AS GROWN FROM 6 to 1 IN 1990 TO 16 to 1 NOW

**Ratio of Federal Funds Spent on Local Noise Abatement Projects  
(soundproofing of homes, etc.)  
to Funds Spent by the FAA and NASA on Noise Research and Technology**



Source: Lukachko and Waitz, 2001



# ***A MORE COMPREHENSIVE APPROACH IS NEEDED***

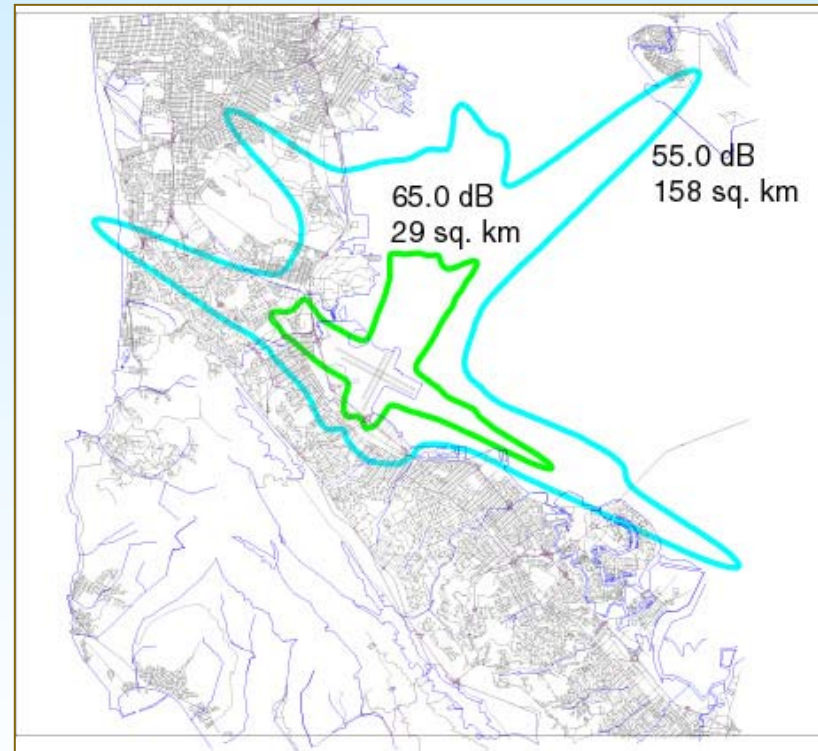
- Start with updating the knowledge base
  - Regulations focus on the 65 dB DNL but some research indicates annoyance and other medical effects begin at lower levels?
  - What is the economic cost of noise to property owners (capitalized in the value of property)?
  - What would property owners be willing to accept in the form of compensation for a noise easement?
  - What are the climatic, regional and local effects of emissions?
    - Risk Assessments/Honest Brokers



# EXAMPLE OF UPDATING INFORMATION AND POTENTIAL CONSEQUENCES

## Effects of Noise on People (Residential Land Uses Only)

Effects Day-Night Average Sound Level in Decibels	Hearing Loss	Annoyance	Average Community Reaction	General Community Attitude Towards Area
	Qualitative Description	% of Population Highly Annoyed		
75 and above	May begin to occur	37%	Very severe	Noise is likely to be the most important of all adverse aspects of the community environment.
70	Will not likely	22%	Severe	Noise is one of the most important adverse aspects of the community environment.
65	Will not occur	12%	Significant	Noise is one of the important adverse aspects of the community environment.
60	Will not occur	7%	Moderate to slight	Noise may be considered an adverse aspect of the community environment.
55 and below	Will not occur	3%		Noise considered no more important than various other environmental factors.



Source: FICUN, 1960; FICON 1992 (Update)



# SOME STARTING POINTS

- Based on updated knowledge base, re-evaluate costs and benefits of:
  - The relative size of investments in research vs. abatement
  - Updated regulations that reflect community effects
    - Noise: That reflect current community standards and consider easements
    - Emissions: Permit trades (including to/from other industries)
  - Regulations to address global warming: Honest Brokers => Risk Assessment
- Keep in mind
  - Pace of growth
  - Long lead times in airline re-equipment cycles
- Consider carefully consequences for the airline industry

