AEROACOUSTICS ANALYSIS AND COMMUNITY NOISE OVERVIEW

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FIRST ANNUAL
HIGH SPEED RESEARCH WORKSHOP
WILLIAMSBURG, VA
MAY 15, 1991

AEROACOUSTIC ANALYSIS AND COMMUNITY NOISE SESSION AGENDA

This is an agenda figure which lists session title, date, and time. It spells out the workshop objectives and lists the session chairman and co-chairman. It presents a detailed agenda of the presentation times, titles, and authors.

AEROACOUSTIC ANALYSIS AND COMMUNITY NOISE SESSION AGENDA

MAY 15 th, 1991 1:00 TO 4:30 P.M.

OBJECTIVES

A). REPORT AND DISCUSS TECHNICAL PROGRESS

B). EVALUATE AND RECOMMEND PROGRAM PLAN CHANGES

Robert A. Golub
Chairman

Paul Soderman
Co-Chairman

1:00 P.M.	Element Overview Robert A. Golub
1:15	Generation of a New Jet Shock Noise Model and Computer Code for ANOPP N. N. Reddy
1:45	Boeing Perspective of Community Noise Technology Needs Gene Nihart
2:15	Current Status of HSR System Noise Allan Mortlock
2:45	ANOPP / VMS HSCT Ground Contour Study Lou Glabb / John Rawls
3:15	High-Performance-Jet-Engine Flight Test Data Base for HSR Jeff Kelly
3:45	Status and Plans for the ANOPP HSR Prediction System Sandra Nolan
4:15	Summary Discussion Robert A. Golub

COMMUNITY NOISE RESEARCH

The goals of the High Speed Research Program are focused on three major environmental issues: atmospheric effects, airport conmmunity noise, and sonic boom. These issues are basic concerns that require better understanding before further HSRP endeavors can be addressed.

Economically viable solutions will be sought for these issues including:

- Valid ozone effect predictions
- Reduction of engine emissions, and the technical basis for acceptability criteria
- Reduction of noise, and compliance with Federal Air Regulation, Part 36, Stage III
- Sonic boom reduction or efficient subsonic overland cruise, and the technical basis for boom acceptability criteria.

This vu-graph expands upon the general research to be performed for community noise compliance.

COMMUNITY NOISE RESEARCH

"Public acceptance of the HSCT will depend upon its ability to meet noise levels standards, currently assumed to be the FAR 36, Stage III levels now applied to newly designed subsonic transports. Reasearch is required to assure reliable prediction of HSCT airport community noise and evaluation of new noise reduction technologies. The research must also examine the feasibility of still further HSCT noise reduction which may be required in the future."

COMMUNITY NOISE REDUCTION ELEMENTS

The noise heard on the ground as an aircraft flies overhead is not only a function of the propulsion system, but also dependent on the aircraft flight path and atmospheric propagation characteristics. In particular, a wing with good takeoff lift performance will help reduce observed noise by quickly carrying the offending engines to high altitudes.

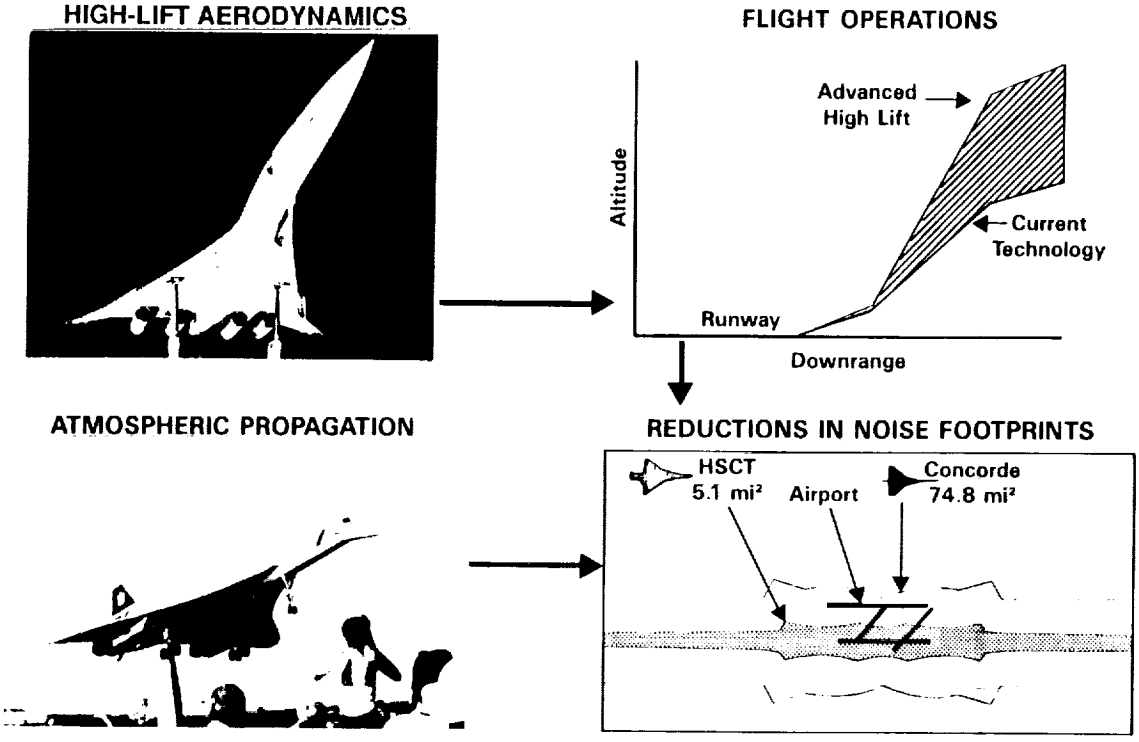
Using noise source models developed in the propulsion noise research, with particular emphasis on takeoff conditions, the Community Noise research will include the following elements:

- Update of atmospheric propagation models.
- Investigation of innovative flight operations to minimize perceived noise, particularly utilizatlon of high lift aerodynamics.
- Prediction of noise footprints (i.e., the ground area subjected to threshold or greater noise levels of interest such as FAR 36, Stage III) for assessment of overall acoustic performance.

COMMUNITY NOISE REDUCTION

HIGH-SPEED RESEARCH PROGRAM

ELEMENTS



HSR COMMUNITY NOISE ISSUES

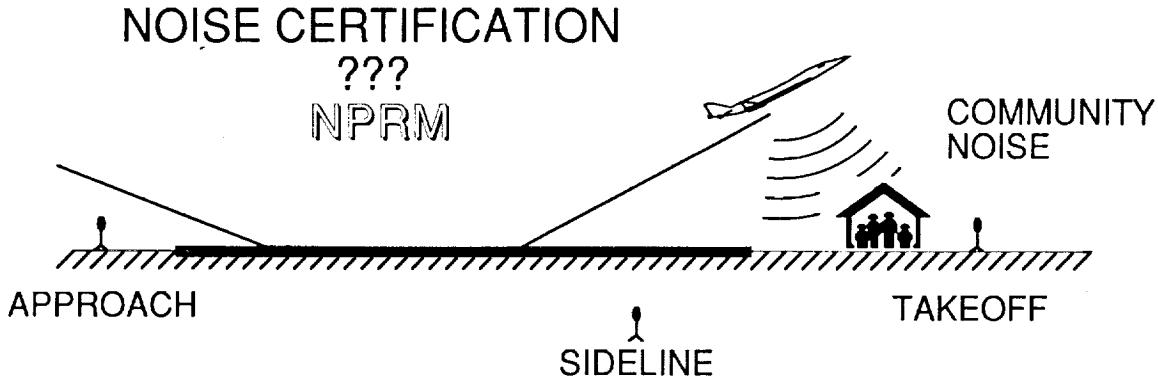
This figure illustrates two of the HSR Community Noise Issues.

The first issues is that of how the HSCT aircraft will be certified. The FAA issued on May 30, 1990 a Notice of Proposed Rulemaking that would require future supersonic transports to meet noise limits consistent with those required for future subsonic aircraft. It leaves open the possibility of providing sufficient flexibility in flight and measurement conditions to allow for optimization of aircraft environmental and economic characteristics and the use of computer controlled aerodynamic and thrust management systems. This allowed flexibility must be, of course, consistent with the required safety.

Based on experiences with the Concorde aircraft and from initial predictions of thrust necessary to achieve economic supersonic flight, it appears that noise from the propulsion plants will have to be reduced by about 20 dB. It appears possible to achieve about 12 to 15 dB reduction from new engine technology including the use of suppressor/ejectors. This still leaves about 5 dB which may have to be eliminated through the use of high-lift technology and advanced operating procedures.

One key element will be the development of system noise prediction capability to allow trade studies to be performed to allow optimal utilization of current and emerging aircraft and engine technologies.

HSR COMMUNITY NOISE ISSUE



20 dB NOISE REDUCTION NEEDED

SOURCE NOISE REDUCTION	15 dB POSSIBLE
ADVANCED OPERATING PROCEDURES HIGH LIFT TECHNOLOGY	5 dB ???

COMMUNITY NOISE REDUCTION APPROACH

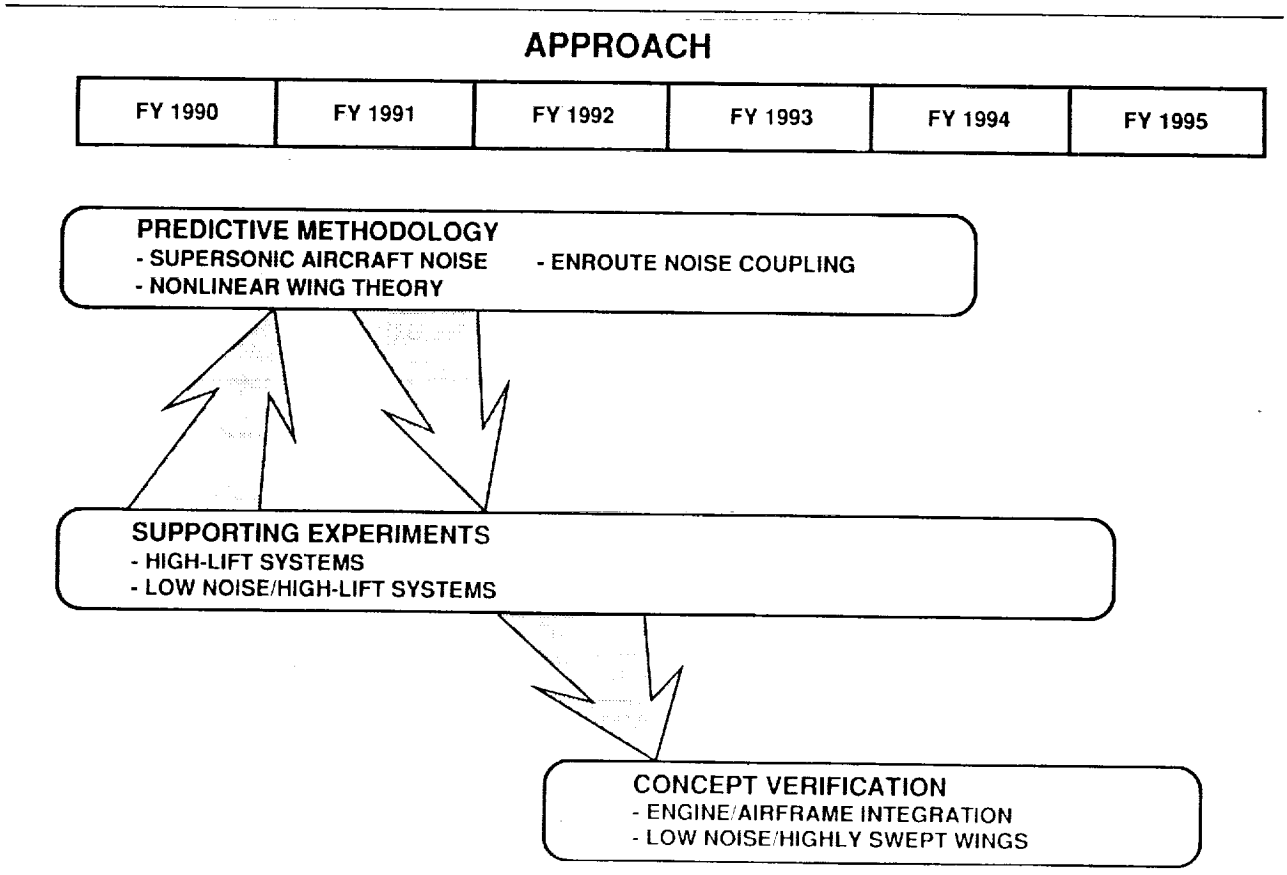
Major advances have occurred recently in the capability to predict the complex vortical flows associated with highly swept wings operating at high angles of attack. The resulting high-lift aerodynamic techniques will be coupled with noise predictions for the advanced engine concepts being evaluated in the HSRP. Community noise computer codes will be modified to incorporate new modules that reflect advances such as active and passive jet noise suppression, and various nozzle geometries and exit velocity profiles.

Component and model-scale tests will be conducted to provide input to the predictive techniques and to help verify the accuracy of the completed analyses. These experiments will address the far-field community noise and the engine/airframe performance integration, as well as the high-lift devices that augment basic wing performance. Tradeoffs of operational procedures will then be conducted to develop new low-noise/high-lift systems for HSCT aircraft.

Concept verification in the HSRP will include a suitable combination of analysis and experiment.

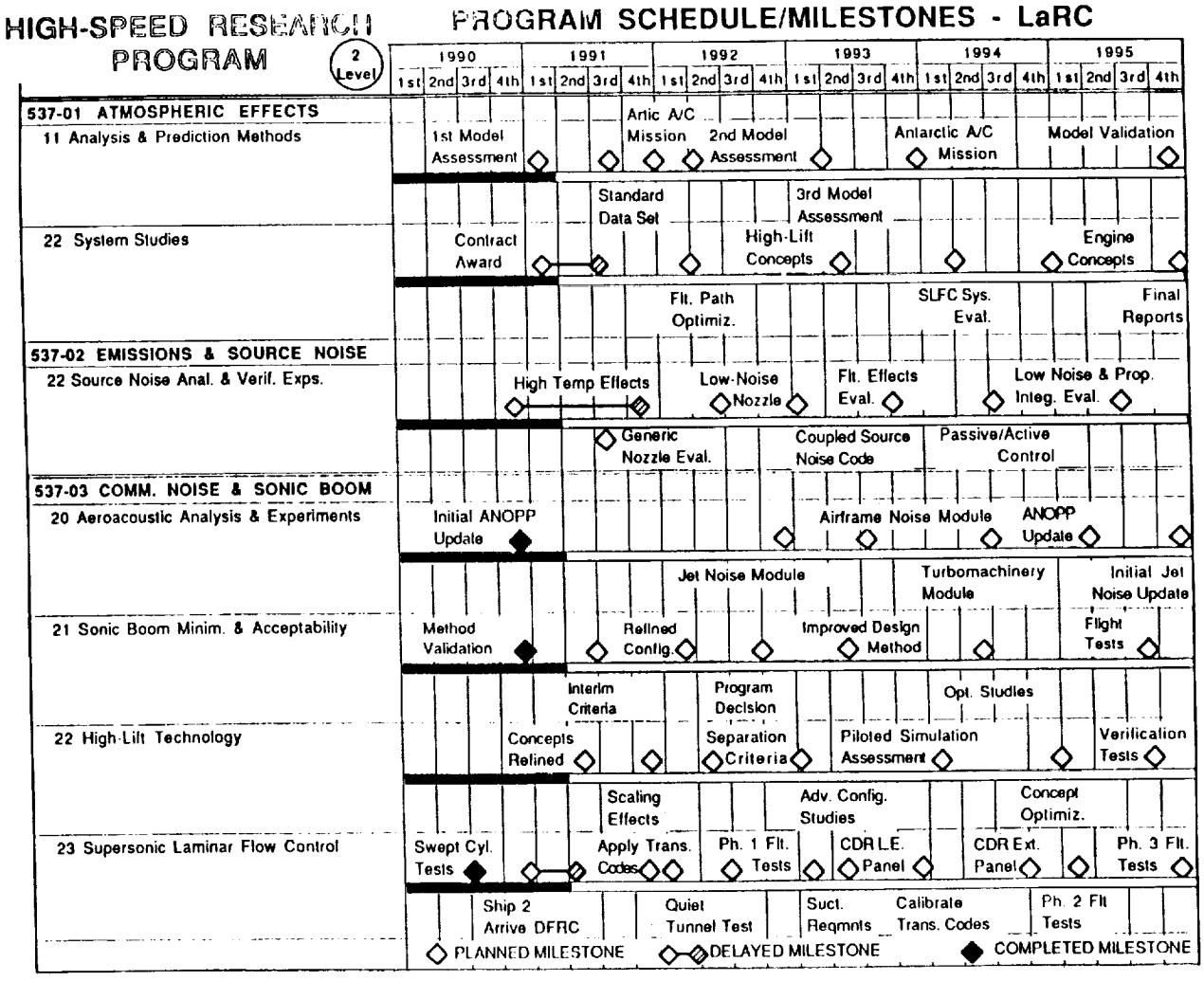
COMMUNITY NOISE REDUCTION

HIGH-SPEED RESEARCH PROGRAM



PROGRAM SCHEDULE/MILESTONES

The schedule and milestones for the Aeroacoustic Analysis and Experiments (AA&E) technology area were originally laid out to provide by the 1995 time frame a sufficiently robust "jet noise" prediction capability to permit environmental and economic system trade-off studies using the potential benefits from concepts such as high-lift, laminar flow, jet exhaust suppression, etc. While the emphasis and ,hence, milestones of the schedule may change as new research/development modifies the relative importance of noise source contribution to community noise, the end goal has to remain firm. The challenge to meet this end lies in the ability to absorb into the on-going AA&E code development and prediction studies the unknown and unexpected elements which may arise. It is expected that this be accomplished in a manner that is consistent with the resources available to meet our established goals. However, one of our jobs - and one of the purposes of this workshop - is to identify any programmatic oversights or short-comings that may not be consistent with our assigned resources and to report to higher management viable alternatives towards meeting the the established goals.



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