ASCENT 38
Rotorcraft Noise Abatement Procedures Development

Motivation and Objectives

Motivation

- Rotorcraft noise is becoming an increasingly larger issue.
- HAI's "Fly Neighborly Guide" helpful for community noise, but since its publication, new rotorcraft and operations have been developed.
- In ASCENT 6, a physics-based noise prediction tool was developed and validated with flight test data. This tool was also demonstrated to be able to predict potential improvements from flight procedures and vehicle design changes.
- The need for detailed and specific noise abatement procedures are addressed in this task.

Objectives

- Utilize computational and analytical modeling to develop noise abatement procedures for various helicopters and various phases of flight.
- Determine if it is feasible to develop noise abatement procedures for categories of helicopters.

Aircraft for Study

- Airbus Helicopters: BK 117, EC145, H145 (3 different generations of essentially the same helicopter), MTOW 7900 lb.; H145 has fenestron.



- Bell 430, MTOW 9300 lb; Bell 429, MTOW 7000 lb.; Bell 206, 2-bladed main rotor, MTOW 3200 lb.



- Sikorsky S-76 C+ and S-76D (different technology levels), MTOW 11,700 lb.; Sikorsky S-92, large/heavy, MTOW 26500 lb.



Summary

Approach

1. **Selection of helicopters to be used for noise abatement procedures**
   - Gross take-off weight
   - Number of main rotor blades
   - Regular vs quiet tail rotor
   - Rotor technology level or rotor "generation"
2. **Analyze noise abatement procedures for each of the selected helicopters**
   - Model helicopters for noise prediction
   - Identify or develop noise abatement procedures
3. **Evaluate whether unique noise abatement procedures should be developed for each category**
   - Determine whether abatement procedures work for different helicopter categories
   - Consider if a category is really representative of individual helicopters in the category
4. **Model noise abatement procedures to demonstrate their advantages**
   - Detailed analysis of abatement procedures

Accomplishments

- Initial list of study helicopters has been selected
  - Several helicopter models have been set up.
    - Bell 430, Sikorsky S-76C+
    - Airbus Helicopters BK 117, EC145
  - Other helicopters models planned
    - Airbus Helicopters H145 (fenestron)
    - Sikorsky S-76D
    - Bell 206? (two-bladed main rotor)
    - Sikorsky S-92? (large/heavy)
- Draft set of flight conditions and maneuvers has been proposed.

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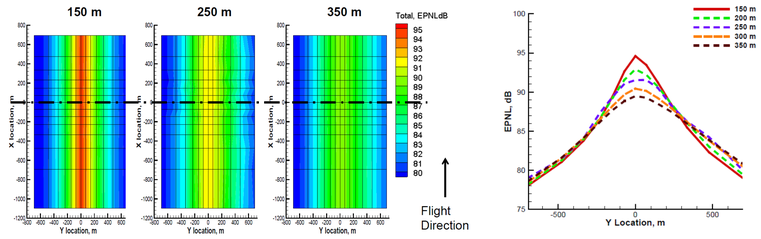
Results and Discussion

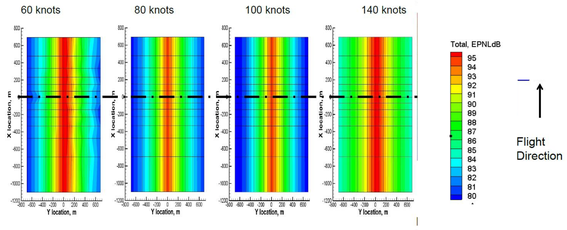
Impact of Altitude

- Level flyover cases at various altitudes from 150m to 350m were considered for the Bell 430 aircraft
  - Significant noise reduction below aircraft, but not to the sides.



Impact of Flight Speed

- Level flyover cases for various flight speeds were also considered
  - Speeds from 60 to 140kt considered.
  - Maximum EPNL below aircraft, not much change with speed



- Work continues to look at other procedures and more aircraft.
  - Descent, Take off.
  - Noise abatement procedures: steep take off; decelerating descent, etc.

Conclusions and Next Steps

- Common sense changes (fly higher, fly slower) don't necessarily yield the expected results everywhere.
- Other flight conditions also being studied.
  - Descent and take off
  - Acceleration and deceleration (especially descent)
  - Noise abatement operations
- Current work focused on setting up models for a range of study helicopters.
  - Challenge getting necessary helicopter configuration data
  - First principles prediction method provides detailed information for understanding the results.