New Generation Mobile Source Emissions Modeling

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MOBILE6

- Current status
  - ⇨Coding and Alpha Testing complete
  - ⇨Limited beta testing underway
- Release: January 31, 2001
- Next Steps
  - ⇨Finalizing technical documentation
  - ⇨Adding PM, Toxics
  - ⇨Validation

MOBILE6 - Major Emission Content Changes

- Exhaust Emissions
  - ⇨Light and heavy duty emission rates
  - ⇨Facility-based off-cycle and speed corrections
  - ⇨Sulfur effects and fuel composition
  - ⇨Heavy duty NOx excess
  - ⇨Air Conditioning
- Evaporative Emissions
  - ⇨Liquid leaker emissions
  - ⇨New diurnals and resting loss data
  - ⇨Multi-day and partial-day diurnals

MOBILE6 - Fleet and Activity Changes

- Fleet characterization
  - ⇨Mileage accumulation
  - ⇨Registration (age) distributions
  - ⇨VMT mix
- Vehicle activity
  - ⇨Trip length estimates
  - ⇨Soak time distributions
  - ⇨Trip start and trip ends
  - ⇨VMT by hour of day, facility, speed

MOBILE6 Structural Changes

- Separation of start/running
- Additional vehicle sub-classes
  - ⇨LDGT 1-4, HDGV 2b-8b, HDDV 2b-8b, Buses
- Database output option - disaggregated by:
  - ⇨pollutant
  - ⇨start/running (exhaust)
  - ⇨resting/running/diurnal/hot soak/refuel (evap)
  - ⇨vehicle class
  - ⇨age
  - ⇨facility
  - ⇨hour

MOBILE6 is a much better tool...

- Better represents real world emissions
- Better estimates program benefits
- More useful tool for transportation applications

BUT

It is still fundamentally a “macro-scale” model.

A NEW GENERATION EMISSIONS

MODEL IS NEEDED

NRC Recommendations

- Develop microscale and mesoscale modeling capability for transportation applications
- Coordinate with DOT, ARB and others to develop long-range mobile source emissions modeling plan
- Improved emission characterization:
  - ⇨ In-use emissions
  - ⇨ High Emitters
  - ⇨ Heavy-Duty Vehicles
  - ⇨ PM and Toxics

NRC Recommendations, cont.

- Model evaluation:
  - ⇨ Validation
  - ⇨ Sensitivity and Uncertainty analyses
- More frequent updates

New Generation Model - Effort to Date

- DOT coordination
  - ⇨Short-term goal: TRANSIMS pilot implementation
  - ⇨Long-term goal: Coordinate TRANSIMS and NGM
- Site visits
  - ⇨ARB: EMFAC2000, GIS work
  - ⇨UC Riverside: Comprehensive Modal Emissions Model
  - ⇨Georgia Tech: MEASURE / MOBILE MEASURE
- Intra-Agency Mobile Source Modeling Workgroup
  - ⇨OTAQ, ORD, OAQPS, Region

New Generation Model - Planning Goals

- Issue Paper / Initial Proposal - April 2001
- Comprehensive Plan - September 2001
  - ⇨ Model system structure
  - ⇨ Model algorithms
  - ⇨ Underlying data and research needs
  - ⇨ Linkage with transportation and air quality models
  - ⇨ Validation plan
  - ⇨ Project timing

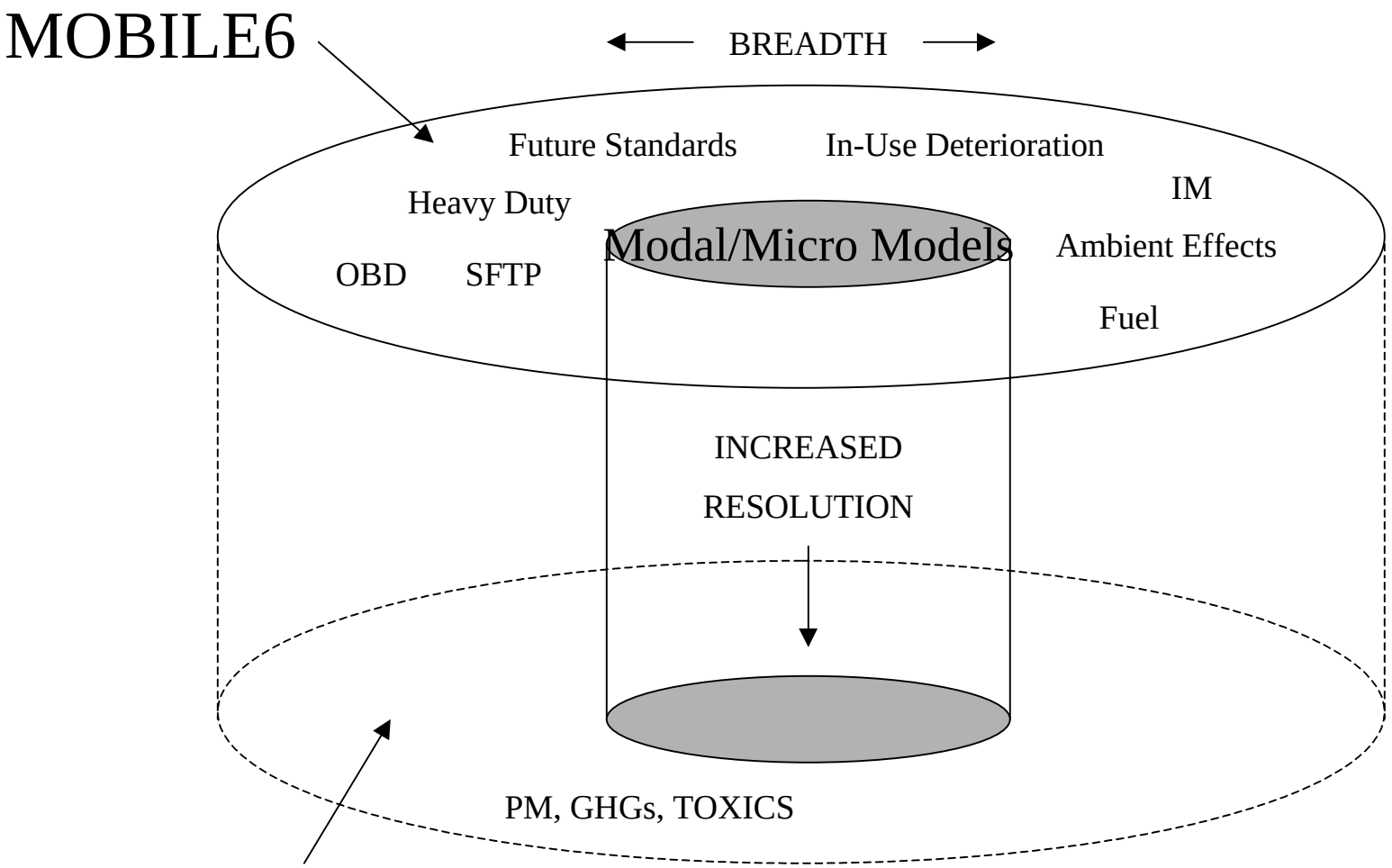
New Generation Model - Proposed Guidelines (1)

COMPREHENSIVE: *Estimate emissions at the microscale, mesoscale or macroscale for criteria pollutants, particulate matter, air toxics, and greenhouse gases*

Considerations:

- Consistency between scales (emissions, activity, fleets)
- What are the important elements at each scale?
  - ⇨ e.g., regional programs less important for evaluating TCMs
- Data limitations (e.g. microscale data for toxics, PM)

Model Scope



New Generation Emissions Model

New Generation Model - Proposed Guidelines (2)

***COMPATIBLE** with current and advanced transportation and air quality modeling frameworks (TRANSIMS, MODELS3)*

Considerations:

- Supporting widely varied approaches/software for transportation activity generation (micro ⟶ macro)
- MODELS3 integration
- Software issues

New Generation Model - Proposed Guidelines (3)

USEABLE *as defined by: ease of use, reasonable software/hardware requirements, ability to generate and input activity and fleet information at the desired level of analysis.*

Considerations:

- "Ease of use" means different things for different users
- External software applications (e.g.GIS)= $$$
- Current meso/micro models require more than a PC
- Users will have wide-ranging data availability:
  - ⇨ Low-end: aggregate VMT, vehicle registration
  - ⇨ High-end: Remote sensing, vehicle address matching, land-use

New Generation Model - Proposed Guidelines (4)

DATA-DRIVEN: *underlying database structure allowing updates based on new data from multiple sources, including in-use emissions and activity data*

Considerations:

- Updates = new data integrated into existing structure
- Goal is a shared dataset
- How would PEMS and/or GPS data fit?

New Generation Model - Proposed Guidelines (5)

MODULAR: *Structured to enable access, updates and validation of individual modules*

Considerations:

- Emission “core” concept
- Some users may only desire certain data elements (particularly emissions), not entire model
- Validation plan defined in advance

New Generation Model - Proposed Guidelines (6)

WELL-DOCUMENTED: *documentation covering the model and its use, model operation, structure, code, algorithms, inputs, testing and user guidance.*

Considerations:

- Guidance documentation will be integral part of system if input data becomes non-standardized

New Generation Model - Proposed Guidelines (7)

"CERTIFIED": *Consistent with emerging EPA guidelines for model development.*

Considerations:

- Council for Regulatory Environmental Modeling (CREM)
  - ⇨ Peer review, validation, uncertainty, documentation
- Coding standards
- Handling uncertainty
  - ⇨ Model predictions and assumptions
  - ⇨ Policy (e.g. SIPs, Conformity)

New Generation Model - Proposed Guidelines (8)

COORDINATED: *Developed in coordination with stakeholder, users and other entities engaged in mobile source modeling*

Considerations:

- Role of the FACA Modeling Workgroup
- Coordination with ARB's post-EMFAC2000 work
- Developing a meaningful comment process

Short-Term Drivers

- Motor Vehicle Toxics Rule
  - ⇨Desire micro/mesoscale emissions modeling in several urban area for improved exposure modeling resolution
- Desire to use microscale models to evaluate transportation measures in conformity analyses
  - ⇨TRANSIMS pilot implementation begins Fall 2001
- Climate Change
  - ⇨Need to develop inventory development capability for policy evaluation

Possible Interim Steps

- Develop macro/meso/microscale capability within Geographic Information System (GIS) framework
- MOBILE6 (with PM, toxics, GHGs) remains the basis of emission predictions
- Source of activity and fleet information depends on analysis scale
- Structure with an eye towards NGM

Possible Interim Steps - Macroscale

- Purpose: Develop a structure for national inventory development using MOBILE6 (w/ PM, Toxics, GHGs)
- Activity and fleet info aggregated by grid or county
- GIS would allow easy shift in scales:

  grid > county > nonattainment > state > region > nation

- Maintain national database for county-level activity, fleet and control program information

Possible Interim Steps - Micro/Mesoscale (1)

- MOBILE6 emissions disaggregated to smaller scale
- Allows evaluation of microscale vehicle activity within MOBILE6 SIP/Conformity budgets
  - ⇨ Initial step could simply be guidance which allows use of micro/meso models within context of MOBILE6 budgets
- Allows more resolved inventories accounting for speed/accel activity, spatial/temporal allocation (Toxics, Climate Change)

Possible Interim Steps - Micro/Mesoscale (2)

- Activity and fleet information
  - ⇨MEASURE (Ga Tech/EPA ORD) framework promising
  - ⇨Activity info via Travel Demand Model
    - Speed and volume by link
      - Disaggregation to speed/accel distribution via driving surveys
    - Trip generation/attraction by zone
      - Further spatial allocation based on land use
  - ⇨Fleet info via vehicle registration database
    - Spatial allocation via address matching, census data
    - Further refinement/validation possible with RSD

Possible Interim Steps - Micro/Mesoscale (3)

- Emissions information
  - ⇨ MOBILE6 (with PM, toxics, GHGs) provides aggregate emissions predictions
  - ⇨ Allocation of MOBILE6 emissions at the link level to account for speed/accel behavior on that link
    - Would require modal or microscale model to accomplish
    - Evaluate existing models (e.g. UC Riverside, Georgia Tech) to determine best approach
  - ⇨ Aggregate MOBILE6 emissions untouched for sources with no micro/meso component (e.g. evap, heavy-duty)

Possible Interim Steps - Micro/Mesoscale (4)

- Target selected urban areas
  - ⇨Could support toxics rule exposure analysis
- Develop guidance for other areas to adopt
- Develop database for activity and fleet inputs

Interim Steps ⟶ NGM

- Update modules as appropriate:
  - ⇨ Emissions
    - More integrated approach to macro/meso/micro emissions
    - Better data resolution on heavy-duty, toxics, PM, GHGs
    - PEMS
  - ⇨ Activity
    - Advanced transportation models, GPS
  - ⇨ Fleets
    - RSD, VIN decoding
- Stretch Goal: Incorporate NONROAD

Next Steps

- Issue Paper / Initial Proposal - April 2001
- Comprehensive Plan - September 2001
- FACA Modeling Workgroup will meet in conjunction with the MSTRS to provide comment on these products
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