

## Version 2.2

Version 2.2 updates several programs and data bases and provides extensions that facilitate the program usage. For further information see [www.janicke.de](http://www.janicke.de).

### Certification and performance based group values

For the emission rates and profiles of aircraft, a distinction is made between certification and performance based group values. In addition, in a statistical evaluation of a movement journal with individual emissions and profiles, the profiles are now also accounted for in the derivation of group values.

In this way it is possible for example to evaluate a movement journal that has been extended by ADAECAM data and to import the resulting group emission values and representative profiles into a scenario project (performance-based scenario calculation). See example book, Section 2.3 and program manual, Section 6.5.

Source Groups		Tracers		Group values a/c
<input checked="" type="checkbox"/> Aircraft	<input checked="" type="checkbox"/> Handling/GSE	<input checked="" type="checkbox"/> FB	<input type="checkbox"/> PM10	<input checked="" type="radio"/> Certification
<input checked="" type="checkbox"/> APU	<input checked="" type="checkbox"/> Vehicles	<input checked="" type="checkbox"/> NOX	<input type="checkbox"/> BNZ	<input type="radio"/> Performance
<input checked="" type="checkbox"/> GPU	<input checked="" type="checkbox"/> Other Sources	<input checked="" type="checkbox"/> HC	<input type="checkbox"/> CO2	
<input checked="" type="checkbox"/> Start		<input type="checkbox"/> CO	<input type="checkbox"/> SOX	

### Project check

On checking the project it is listed whether emission rates and profiles agree with the default values of the LASPORT data base. Emission values are checked for completeness.

This provides the user with a quick overview of the project data and on the usage of default values of user-defined ones for emissions and profiles.

### Explicit specification of NO<sub>2</sub> emissions

In addition to the emission of NO<sub>x</sub>, the emission of NO<sub>2</sub> (primary NO<sub>2</sub>) can be specified. The data base of vehicle emissions contains explicit primary emissions of NO<sub>2</sub>.

### Specification of monitor points

Monitor (receptor) points, for which the time series of concentration values is written out, can be interactively set in menu *Project/Objects*. Whether these points are applied in the dispersion calculation is set in menu *Project/Parameter*.



The screenshot shows the main interface of LASPORT 2.2.1. On the left is a menu tree with options like Help, File Comparison, File Editor, Scale Maps, Merge Results, Project, Movement Journal, Parameters, Emissions, Traffic, Objects, Calculation Area, Meteorology, Analysis, Concentrations, and ICAO 9889. The central area is a 'Project Directory' for 'D:\test-lsp\monitor' with fields for Mode (Monitor calculation), Country/Airport (CAEP / CMA), Title (Test), User (UJ), and dates. It also includes checkboxes for Source Groups (Aircraft, APU, GPU, Start) and Tracers (Handling/GSE, Vehicles, Other Sources, FB, NOX, HC, CO, SOX, PM10, BNZ, CO2, SOX). A 'Notes' section lists imported data and calculations. On the right, a text frame shows a log of operations: '2 monitor points', 'Reading file \_traffic.csv...', '9 aircraft groups', '4 vehicle groups', 'Reading file \_emission.csv...', 'Project read in.', followed by checks for runways, routes, position areas, taxiways, emissions, and profiles. A 'Project data complete' message is at the bottom.

The main window of LASPORT contains on the left hand side a menu tree, in the centre a setting area for user input and selection, and on the right hand side a text frame with menu-specific data and protocol information. The yellow window at the bottom (this one here) contains menu-specific help. Most components and input fields provide a tool tip which is displayed when moving the mouse cursor on top of the name or component. The LASPORT manual is loaded with menu Help.

The screenshot shows the 'Vehicle Emissions' window in LASPORT 2.2.1. It features a table with columns for Scenario, Unit, FB, NOX, NO2, and HC. The table lists emissions for various vehicle types (PC, LCV, HGVI, BUS) across different scenarios (A1, A2, A3, L1, L2, L3, L4) and units (g/km). The values are displayed in floating point notation. Below the table are options for 'Insert Default Values', 'Reference Year' (2012), and 'Replace all values' or 'Replace only negative values'. A 'Check' and 'Apply' button are at the bottom. On the right, a list of vehicle types is shown, and a tab for 'APU Emissions' is visible at the bottom.

Scenario	Unit	FB	NOX	NO2	HC	
PC	A1	g/km	107.42900	0.60328	0.19026	0.05540
LCV	A1	g/km	99.03660	1.05230	0.30237	0.08567
HGVI	A1	g/km	381.42900	11.01570	0.96994	0.34448
BUS	A1	g/km	480.96100	15.69500	3.28391	0.41652
PC	A2	g/km	76.30370	0.43172	0.13415	0.03613
LCV	A2	g/km	79.01840	0.86161	0.24477	0.06313
HGVI	A2	g/km	287.54800	8.06099	0.70937	0.25587
BUS	A2	g/km	520.33000	15.42860	3.22342	0.47224
PC	A3	g/km	71.71580	0.44616	0.14052	0.03319
LCV	A3	g/km	75.97540	0.92901	0.26521	0.05296
HGVI	A3	g/km	264.19300	6.90527	0.60927	0.21676
BUS	A3	g/km	512.48200	14.57520	3.03005	0.37726
PC	L1	g/km	44.48990	0.25304	0.08211	0.01362
LCV	L1	g/km	59.70460	0.90442	0.26219	0.02601
HGVI	L1	g/km	213.74700	2.80793	0.30306	0.06026
BUS	L1	g/km	210.73400	4.48470	0.58663	0.15576
PC	L2	g/km	45.12980	0.27757	0.08704	0.02040
LCV	L2	g/km	58.38070	0.82983	0.23964	0.03094
HGVI	L2	g/km	191.66600	3.04634	0.29111	0.08860
BUS	L2	g/km	254.24500	5.54610	0.73029	0.19451
PC	L3	g/km	53.38280	0.30158	0.09259	0.02205
LCV	L3	g/km	61.14610	0.72780	0.20740	0.04031
HGVI	L3	g/km	188.40600	4.25891	0.38178	0.13324
BUS	L3	g/km	324.41100	8.09541	1.15176	0.31038
PC	L4	g/km	82.23310	0.50534	0.12724	0.73726

For most emission values, either user-defined values or default values of the LASPORT data base (file \_lasport\_db\_dfl.csv in subdirectory



## New vehicle group BUS

The vehicle group BUS has been added to the groups PC, LCV, and HGV.

## Incorporation of LASAT 3.3

The programs of the current program package LASAT 3.3 have been incorporated. This yields some useful extensions to LASPORT, for example:

- 32-bit and 64-bit program versions are available. The choice is made during installation.
- On the extraction of concentration files during the result analysis, a report with the main results of the dispersion calculation is provided (file LspResp.log), similar to AUSTAL2000.
- In the graphical display of concentration distributions an overlay with the value matrix can be applied.

The screenshot displays the LASPORT 2.2.1 software interface. The main window is titled "LASPORT 2.2.1 [Arbeitsgemeinschaft Deutscher Verkehrsflughafen (ADV), Berlin] D:\test-lsp\monitor". The interface is divided into several sections:

- Project Directory:** Shows the current project path as "D:\test-lsp\monitor" and the mode as "Monitor calculation".
- Country, Airport:** Set to "CAEP / CMA (CAEP Model Airport (CAEport))".
- Title:** "Test".
- User:** "DJ".
- First day / Last day:** Both set to "2012-01-01".
- Source Groups:** Includes Aircraft, APU, GPU, Start, Handling/GSE, Vehicles, Other Sources.
- Tracers:** Includes FB, NOX, HC, CO, PM10, BNZ, CO2, SOX.
- Group values a/c:** Includes Certification, Performance.
- Notes:** A list of imported data from a movement journal, including total movements, distribution over arrival/departure runways, position areas, and routes.
- Check project data:** A section with radio buttons for "Calculate overall emissions", "Run dispersion calculation", "Re-analyse concentrations", "Info panel", "LspEmiss.log (emissions)", "LspEmiss.log (tables only)", "LspTrans.log (preparation LASAT)", "lasat.log (log file LASAT)", and "LspResp.log (missions)".
- Result evaluation:** A detailed report for "D:\test-lsp\monitor" showing various metrics like DEP, DRV, WET, Y00, Dnn, Hnn, and a table of concentration values for different pollutants (HC, NO, NO2, NOX) at various points (Y00, H00) and times (mnt1, mnt2).

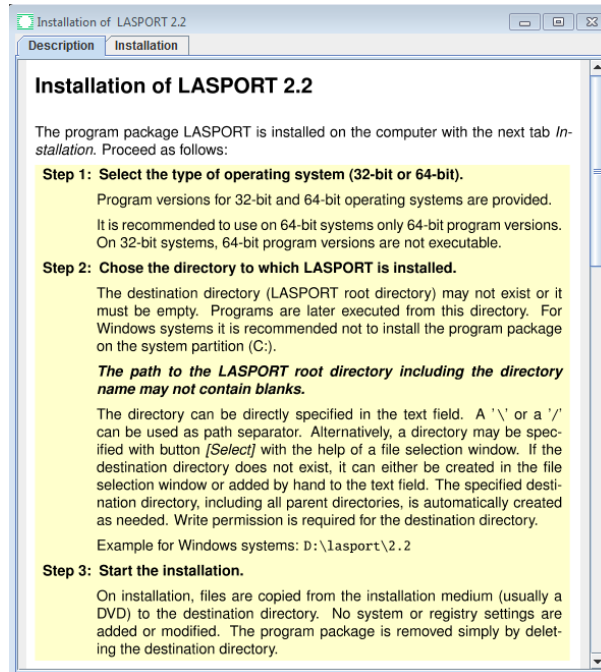
## Updated LASPORT data base

The data base has been updated, in particular the provided emission defaults. Among other: Updated group values based on the aircraft traffic at Zurich Airport 2013, current Issue 20 of the ICAO Engine Emission Databank, current HBEFA Handbook 3.2 with vehicle emissions, updated GPU/GSE emissions.

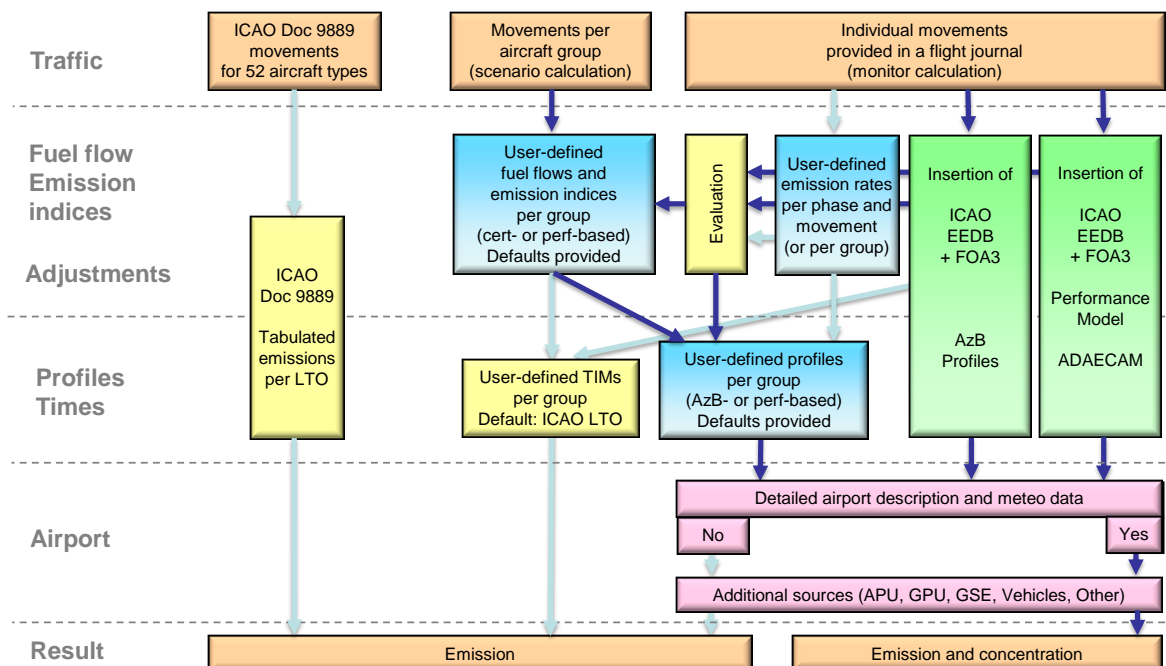


## Installation program

A new, interactive installation program takes care for the installation of LASPORT and the selection of 32-bit and 64-bit program versions.



## Selected pathways in LASPORT 2.2





## Changes in detail

(extract from the program manual)

### LASPORT Update 2.2

- Implementation of LASAT 3.3.

LASPORT applies now the LASAT tools (*Lopxtr*, *Loprep*, *Lopser*) for result evaluation. The update to LASAT 3.3 yields several advantages:

  - Coordinates are not restricted to an absolute value less than 200 000 (metre). However, it is still recommended to specify coordinates relative to a reference point for better readability of the data.
  - The programs are provided as 32-bit and 64-bit versions. The 64-bit versions allow to use more RAM. It is recommended to apply on Windows 64-bit systems always the 64-bit versions.
  - In the results evaluation, monitor points can be accounted for.
  - A report file with the main results is provided (*LspResp.log*).
  - In the graphical display of concentration distributions the value map can be shown.
  - The log file *lasat.log* contains the total emissions for each substance. As the values have been derived from the LASAT input files, their agreement with the total emissions calculated by LASPORT provides a strong validity cross check.
- Updated data base.
  - Aircraft types (file *\_lasport\_db\_act.csv*): small adjustments.
  - Airports (file *\_lasport\_db\_apt.csv*): small adjustments and corrections.
  - Engine emissions (file *\_lasport\_db\_eem.csv*): implementation of the current ICAO EEDB (Issue 20), public FOCA values and UID types applied at Frankfurt Airport.
  - Vehicle emissions (file *\_lasport\_db\_df1.csv*): implementation of values of the current handbook HBEFA (version 3.2, covering the years 2005 to 2025) with primary emissions of NO<sub>2</sub> and new vehicle group BUS.
  - GPU and GSE emissions (file *\_lasport\_db\_df1.csv*): implementation of updated values from Zurich Airport.
  - Helicopter profiles (file *\_lasport\_db\_df1.csv*): climb angles and TIMs adjusted to the recommendations of the FOCA Guideline (2009).
  - Default values for group emissions and group profiles (both certification- and performance-based) on the basis of aircraft traffic at Zurich Airport 2013.
- Explicit specification of primary NO<sub>2</sub>.

NO<sub>2</sub> emissions can be explicitly provided together with the emissions of NO<sub>x</sub>. If the emission of NO<sub>2</sub> is not provided or undefined (negative value), it is derived from the



provided NO<sub>x</sub> emission and an average fraction (by default 0.15) like before. The emission of NO is derived like before from the emissions of NO<sub>2</sub> and NO<sub>x</sub>. User-defined emission values of NO are ignored.

- Improved project check.

On checking a project, a detailed list is provided which emission values and profiles have been set to the LASPORT default values. Emission values are checked for completeness and a warning is given if an invalid or negative value has been encountered. In monitor calculations, information on the contents of the movement journal is provided. The check results are written to file `LspCheck.log`.

- Monitor points.

In menu *Project/Objects* monitor (receptor) points can be defined. The time series of concentration values (hourly means) at these points are written to separate files and evaluated. Menu *Project/Parameter* (parameter `UseMonitors` in file `_project.csv`) allows to select if monitor points are accounted for or not.

- New vehicle group BUS.
- Improved installation by an interactive, graphical installation program.

#### Other changes

- Start time and end time of the project (both referring to 0:00 am) displayed in *Project* in the form *First day* and *Last day*.
- On inserting ICAO values into the movement journal, a given AzB class is applied also as profile name.
- On evaluation of a movement journal, the departure queuing time is evaluated.
- Monitor calculations based on a movement journal with emission rates.

If an individual emission rate is not set or set to an invalid or negative value, it is derived from the group emission index and, if defined, the individual fuel flow rate (before 2.2: the group fuel flow). In this way, a generic ratio of emission rate and fuel consumption (e.g. 3.155 for CO<sub>2</sub>) is preserved in the overall emission.

This change may result in minor changes of the overall emission when re-calculating an old project. Beside this change, re-calculation of an old project with LASPORT 2.2 yields exactly the same emissions as before because all relevant information is contained in the project files.

- Improvement of the interpolation routine in ADAECAM.

ADAECAM applies an interpolation rule for the emission indices of HC and CO as a function of combustion temperature (or thrust setting), where two lines are defined in a log-log plot. One line connects the values at idle and approach and is decreasing, the other line serves as constant minimum value which is set to the mean of the values at take-off and climb. Usually, the value on the first line decreases between approach



and climb until it reaches the minimum value. However, for some engines of the ICAO EEDB the emission index of HC or CO at approach is comparable or even larger than at idle. In this case the interpolation rule yields values for larger thrust settings that are too high.

The interpolation scheme was modified such that if the first line increases or if the first line crosses the minimum line at a temperature (or thrust larger) than the one at climb, a linear interpolation is applied between the values of approach and climb, the mean of climb and take-off still serving as a minimum (version ADAECAM 1.0.3).

- Updated JRE (version 1.7.0\_72).

### **LASPORT Update 2.1**

Update 2.1 allows to distinguish between certification-based and performance-based group values for aircraft emissions and profiles. This extension allows to import ADAECAM based emissions and profiles into a scenario calculation.

When reading a project prepared by LASPORT 2.0, the new sections

- `TABLE.EMISSION.PERF.AC` (file `_emission.csv`)
- `TABLE.PROFILE.PERF.ARRIVAL` (file `_traffic.csv`)
- `TABLE.PROFILE.PERF.DEPARTURE` (file `_traffic.csv`)

are automatically added to the project and set to their default values.

- Improvement of the evaluation of emission values in a movement journal.

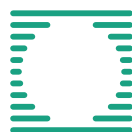
If the journal contains individual emission rates and profiles, average rates for each aircraft group are calculated as before. However, not a simple average of the emission rate but an average weighted with the individual times-in-mode (resulting from the individual profile) is performed (yielding the averaged mass) and the most frequently used profile is identified. Finally, the averaged mass of a LTO segment is divided by the time-in-mode of that profile (averaged emission rate) and both, averaged emission rates and representative profile, are listed in file `LspEval.log` as group average. These defaults can be imported into the project.

The concomitant use of both average rates and representative profile yields a closer agreement of the overall emission in a subsequent scenario calculation with the overall emission of the corresponding monitor calculation. In addition it allows to import performance-based data into a scenario project.

- Selection between certification-based and performance-based group values for aircraft emissions and profiles (new parameter `DefaultsBase` in file `_project.csv`).
- New group defaults for performance-based aircraft emissions and profiles.
- Automatic setting of the turbulence scaling factor (before `SigFactor` in the movements journal) according to the value of `DefaultsBase`.



- Enhanced project check with information on applied default settings for emissions and profiles and information on the contents of the applied movements journal. The information is also written to the new file LspCheck.log.
  - Missing meteo data for ADAECAM.  
If a time interval requested by ADECAM from the meteorological time series is not available, the specified default values are applied (LASPORT 2.0: the values of the interval closest to the requested one). The time interval covered by the meteorological time series is written for information into the header part of the created movement journal.
  - Separator character 'T' instead of '.' in some time strings (ISO format). Input files may still use the latter.
  - Known problems resolved (2011-07-13, 2012-07-06, 2013-11-29, 2014-06-04).
  - Speed improvements.
  - Updated JRE (version 1.7.0\_55).
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