

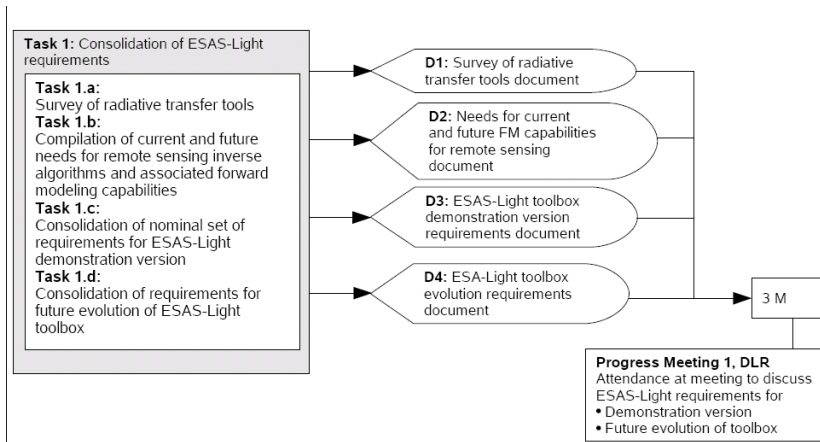
Towards a Generic Radiative Transfer Model for the Earth's Surface-Atmosphere System: ESAS-Light Proposal

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Oberpfaffenhofen

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Task 1 - Literature Reviews



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- ▶ Compile list of existing tools
 - ▶ method to solve RTE
 - ▶ spectroscopic databases for absorption cross sections
 - ▶ spectral range and resolution (correlated-k, spectrally resolved)
 - ▶ assumptions about atmospheric geometry (1D/3D, spherical/plane-parallel ...)
 - ▶ surface properties (albedo, BRDF)
 - ▶ ...
- ▶ Requirements of current and future needs for remote sensing
 - ▶ satellite missions: MSG, MTG, Metop, EarthCare ...
 - ▶ extraterrestrial missions (Mars, Venus)
 - ▶ ground based radiation measurements
 - ▶ air-borne measurements

General Requirements (Preliminary)

Req. No.	Description	incl. in <i>libRadtran</i>
1-1	Forward modelling capabilities for Earth's Surface-Atmosphere system for sun light and Earth emitted light	yes
1-2	0.2 μm to 50 μm , observations of passive looking instruments	yes
1-3	Different modules with various degrees of precision and computational time	yes
1-4	Land and ocean surfaces	yes
1-5	Clouds at various altitudes and of various types	yes
1-6	Operation under UNIX(SUN), Windows, Linux and MAC	yes
1-7	Code that can be run with no cost (GNU public licence)	yes
1-8	Coded in widely used language (C, Fortran,Java)	yes
1-9	Modular design	yes
1-10	Different sources of illumination	no

Functional Requirements (Preliminary)

Req. No.	Description	incl. in <i>libRadtran</i>
2-1a	Monte Carlo with polarization	partly
2-1b	Fast vector code	yes
2-1c	Fast scalar code	yes
2-2	Absorbtion cross sections by correlated-k and line-by-line methods	yes
2-3	Possibility to combine different options	yes
2-4	Monochromatic or spectral calculations	yes
2-5	Raman scattering	no
2-6	Coupling between absorption and scattering	yes
2-7	Refraction of the atmosphere	partly
2-8	Plane-parallel representation of clouds and surface	yes
2-9	Interaction of light with water bodies	yes
2-10	Parameterizations of Cox and Munk (1954 a,b) and Ebuchi and Kizu (2002)	partly

Functional Requirements (Preliminary) ctd.

Req. No.	Description	incl. in <i>libRadtran</i>
2-11	Simulation of light with water surfaces in IR	yes
2-12	Interaction of light with snow and ice	yes
2-13	Simulation of various surface types	yes
2-14	Expandable library of surface properties	yes
2-15	Interaction of light with various pre-defined atmospheres	yes
2-16	User should be able to define their own surface-atmosphere system	yes
2-17	Variable number of layers	yes
2-18	Ability to do simulations in spherical atmospheres	yes
2-19	Output quantities: Radiances/ reflectances/ brightness temperatures at any height, atmospheric albedo, solar irradiance, direct/diffuse transmittance of various gaseous components	yes

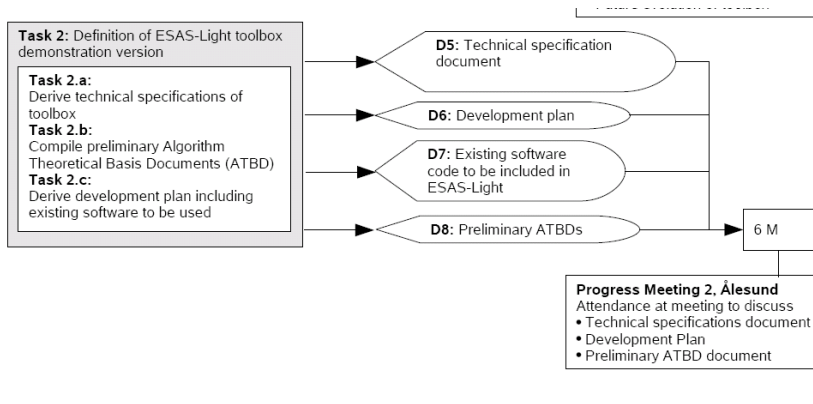
Human Machine Interface (HMI) Requirements

Req. No.	Description	incl. in <i>libRadtran</i>
3-1	Run program from HMI or in batch mode	yes
3-2	Ability for user to enter all parameters of a simulation	yes
3-3	Visualize input of simulations	no
3-4	Summary spreadsheet displaying inputs and outputs of simulation	no
3-5	Visualize outputs of simulations	no

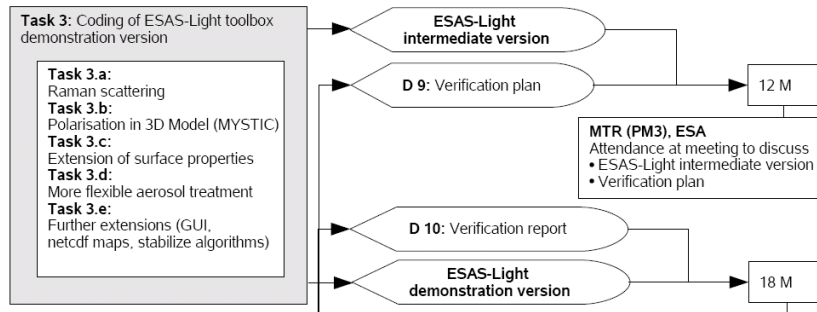
Help Requirements (Preliminary)

Req. No.	Description	incl. in <i>libRadtran</i>
4-1	Online help (text document describing all toolbox functions)	yes
4-2	Keyword search tool	no
4-3	Explicitely documented code	partly
4-4	Tutorial for developer users	no

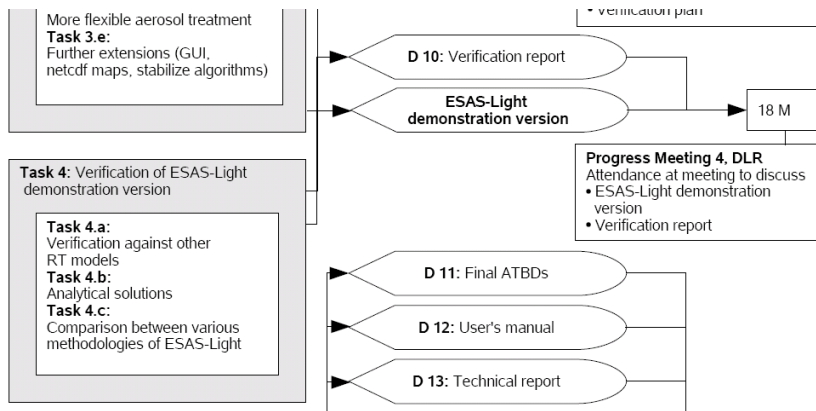
Task 2 - Definition of Demo-Version



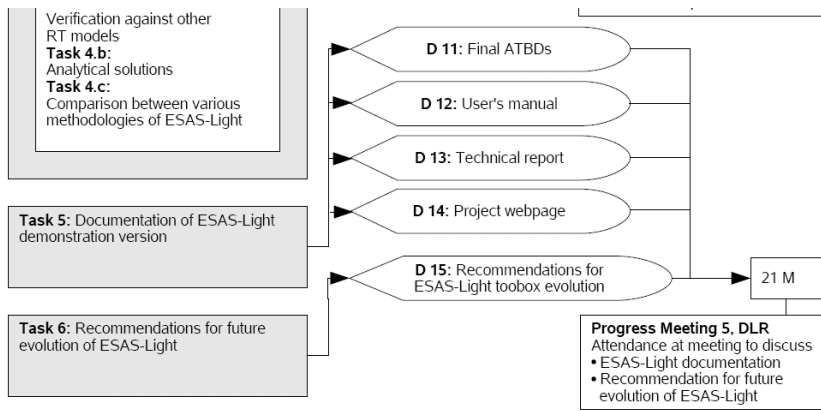
Task 3 – Algorithm development



Task 4 – Verification



Tasks 5 and 6 – Documentation and Recommendations



Time Schedule

		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
WP 0000	Management																								
WP 1100	RT survey																								
WP 1200	Inversion alg. survey																								
WP 1300	Current requirements																								
WP 1400	Future requirements																								
WP 2100	Tech. specifications																								
WP 3000	Coding of ESAS-Light																								
WP 3100	Raman Scattering																								
WP 3200	Polarization in 3D																								
WP 3300	Surface Properties																								
WP 3400	Aerosol handling																								
WP 3500	Further extensions																								
WP 4100	Verification plan																								
WP 4200	Verification																								
WP 5000	Documentation																								
WP 6000	Recommendations																								
WP 0200	Final report																								

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Name	Task	Time Allocation	Time Frame
Dr. Claudia Emde	Project Manager, User Requirements, algorithm development (polarisation), documentation, validation	65%	Project duration
Dr. Arve Kylling	Algorithm development (Raman scattering), documentation, validation	25%	Project duration
Dr. Bernhard Mayer	Algorithm development	10%	Project duration
Ulrich Hamann	Algorithm development, documentation, validation	65%	m. 7–24

Meeting plan

Month	Meeting	Venue	DLR	AK	Comments
0	KO	ESTEC	2	1	Kick-Off
3	PM1	DLR	3	1	Review of Task 1
6	PM2	Ålesund	3	1	Review of Task 2
9	PM3	DLR	3	1	Algorithm development
12	MTR	ESTEC	2	1	ESAS-Light intermediate version, verification plan
15	PM4	ESTEC	2	1	Installation of ESAS-Light
18	PM5	DLR	3	1	ESAS-Light demo version, verification report
21	PM6	DLR	3	1	Documentation, Recommendations for future work

Milestone Payment Plan

Milestone Descriptions	Schedule Dates	Amounts in EURO	Company
Advance: upon signature of contract by both parties; i.e. Kick-Off	T 0	120000.00	DLR
Progress: Upon presentation of deliverables 1-8 on progress meeting 2	T0 + 6	70000.00	DLR
Progress: upon presentation of deliverable 9 and ESAS-Light intermediate version on midterm meeting	T0 + 12	70000.00	DLR
Progress: upon presentation of deliverable 10 and ESAS-Light demonstration version	T0 + 18	70000.00	DLR
Final: upon acceptance of all contractual obligations	T0 + 24	70000.00	DLR