

## Comments received on the Data Link Roadmap

### Group

- 1 Link performance (of VDL2, VDL3, VDL4) (including data rates)
- 2 Co-site and onboard issues, and spectrum allocation (including number of channels required)
- 3 Technology availability / maturity (including deployment plans)
- 4 Future data link technologies
- 5 Information
- 6 General comments
- 7 Other
- 8 Roadmap / timescales
- 9 Costs / benefits
- 10 Applications

No.	Author	Group	Document	Section referred to	Comments	Response
1	SITA	5	General	General comment 1	The SITA AIRCOM Datalink Service today comprises (1) over 650 VHF ACARS stations deployed in over 165 countries (2) Global satellite access via the INMARSAT Data 3 aeronautical service.	Added to Annex F
2	SITA	5	General	General comment 1 (cont)	The SITA VHF AIRCOM Datalink service has over 120 airlines/aircraft operator customers which have over 5,000 VHF ACARS equipped aircraft that use the service on an almost daily basis, exchanging on average 11.5 million kilobits per month. Over sixty percent of this traffic is exchanged over the European region where the service operates on 3 frequency channels.	Added to Annex F
3	SITA	5	General	General comment 1 (cont)	Over 2,000 (representing seventy customers) of these aircraft are also equipped with SATCOM avionics that exchange, on average, over 2 million kilobits per month.	Added to Annex F
4	SITA	5	General	General comment 1 (cont)	Since the early 1990's an increasing number of air traffic service providers have started to use the AIRCOM Datalink service to exchange Air Traffic Service related application data which currently accounts for around 5% of the total traffic exchanged over the service.	Added to Annex F
5	SITA	5	General	General comment 1 (cont)	SITA is fully committed to supporting the cost-effective implementation of the ICAO CNS/ATM system and has made significant contributions to both the ICAO ATN and AMCP Panels that have defined the technical standards for ATN and VDL technology.	Added to Annex F
6	SITA	5	General	General comment 1 (cont)	Furthermore, SITA actively supports and contributes to both ICAO and IATA regional planning and implementation groups that are focusing on CNS/ATM implementation. In Europe, SITA is a member of the Eurocontrol Link2000+ Programme Steering Group that is overseeing and coordinating the implementation of CPDLC services in Europe. The Link2000+ Programme is the first European wide programme that will introduce ATS Datalink applications. To date the programme has the commitment of two major airlines, Lufthansa and SAS who have both committed to upgrading 20 aircraft each with CPDLC/ATN/VDL2 capable avionics by end 2004. On the ground side, Maastricht UACC has committed to the introduction of CPDLC services over the ATN/VDL2 infrastructure by mid 2003.	Added to Annex F
7	SITA	5	General	General comment 1 (cont)	Furthermore, both of these airlines have made decisions to equip their entire fleets with VDL2/AOA avionics. It is expected that the LH fleet upgrade will be completed by 2006/7 and the SAS upgrade by 2010.	Added to Annex F
8	SITA	5	General	General comment 1 (cont)	Given the above, SITA is extremely well placed to provide the benefits of the provision of a global datalink service experience as positive, pragmatic and constructive feedback to the CEC Datalink Roadmap study.	Agreed, No change
9	SITA	6	General	General comment 1 (cont)	SITA's overall impression of the Datalink Roadmap is that it is highly unrealistic in terms of timing, is unfairly critical of VDL2 technology and tries to promote the benefits of VDL4 technology. In order for the Datalink Roadmap to provide a useful basis for future work, these concerns must be addressed from a purely technical and feasibility aspect.	General changes made

10	SITA	3	General	General comment 1 (cont)	Specifically: · It is not realistic in terms of timing (e.g. "Step 1" assumes 75% of the European aircraft and ACCs will be VDL2 equipped by 2006. This is extremely optimistic as by 2006 there will likely be only 2, maybe 3 ACCs equipped to support ATS Datalink (as today there are none) and, at most 100 – 200 aircraft. As a result, Step 1 cannot be assumed to be realistically "completed" (i.e. "widespread" until the 2011/12 timeframe. Consequently, the subsequent steps need to be delayed accordingly.	Mikes
11	SITA	6	General	General comment 1 (cont)	· The theory that the airlines, having invested fleet wide upgrades to VDL2/AOA by 2010 will then simply move onto VDL4 for communications demonstrates an incomprehension of economics of the airline industry.	Noted,
12	SITA	1	General	General comment 1 (cont)	· The study is biased to promote VDL4 and unfairly critical of VDL2. For example, it is stated a number of times throughout the study that VDL2 will require a large F31 number of channels to support the foreseen requirements in Step 4 whilst no statement whatsoever is made regarding the number of channels that would be required by the VDL4 technology to support the same application exchange requirements.	General changes made
					VDL2 channel will provide 10 times the capacity of the existing VHF ACARS channel, i.e. for Europe, where approximately 7 million kilobits are exchanged monthly today over 3 VHF channels, the effective capacity will be increased to 70 million kilobits which SITA believes will more than adequately meet foreseen increases in AOC communications as well as the requirements for ATS applications. If the number of channels is increased from 3 to 6 this would effectively double the capacity, i.e. enable the exchange of 140 million kilobits per month.	Added to Annex F
13	SITA	6	General	General comment 1 (cont)	· Even if the technical significant issues surrounding VDL4, which, incidentally are not equally addressed in the report or even mentioned in the Executive Summary, are resolved then the question of supporting both communications and surveillance applications on a single technology will result in serious safety issues that may prove insoluble. For example, SAS clearly stated at the Link2000+ PSG on 29th January that they do not foresee VDL4 supporting Datalink communications.	General changes made
14	SITA	6	General	General comment 1 (cont)	· Should future public funding to support Datalink technology development and implementation be made available, it should be allocated to those technologies that are feasible, proven and, for which, there is general industry consensus to proceed	Noted
15	SITA	6	General	General comment 1 (cont)	· No account has been taken of the CANSO Datalink Position Paper.	Added
16	SITA	3	General	General comment 2	As a general comment, SITA is of the opinion that the timescales defined in the roadmap for the introduction and widespread implementation of air/ground ATM applications is extremely optimistic. For example, Step 1 assumes "widespread operational use by 2006" where "widespread is defined as " Note that widespread operational use is defined in the study as the date when 75% of aircraft are equipped with the necessary technology and 75% of the ground systems support the ATM application."	
17	SITA	3	General	General comment 2 (cont)	Based on current planning of the Link2000+ Programme which is essentially overseeing the first operational implementation of CPDLC services in core Europe, apart from Maastricht UACC there are no committed plans for ATS providers to implement the technology.	Added to Annex F
18	SITA	3	General	General comment 2 (cont)	An optimistic view by 2006 would be 2 maybe 3 ACCs equipped if one takes into account existing update cycles of planned upgrades by the ATS providers for their ATC systems. With respect to airline equipage, there are currently only 46 pioneer aircraft committed to join the Link programme by 2004, it is therefore extremely unlikely that 75% of the European fleet will equip by 2006. A more realistic, yet optimistic, estimate would be 15%. Deployment can of course be accelerated if there was a mandate imposed on ACCs and airlines, however, given a 7 year notice period the soonest it could come into effect is circa 2010.	Added to Annex F

19	SITA	6	Exec Summary	Exec Summary, 2nd par.	<p>"The list of ATM applications was reviewed extensively by Stakeholders and agreement was reached as to the priority and timescales for each ATM application."</p> <p>To what extent have the decision makers in the major European ATS provider organisations committed to the set of ATM applications and associated timescales ?The introduction of new ATM functionality is typically tied in with windows of opportunity whereby a FDPS is being replaced/upgraded and these "windows" need to be factored into the timescales for ATM application implementation.</p>	Noted
20	SITA	6	Exec Summary	Exec Summary, 2nd par.	To what extent has there been liaison with the EUROCONTROL ODIAC group that is defining future ATS Datalink services ?	Their documents are key references used in Phase 1 and early stages of Phase 2.
21	SITA	6	Exec Summary	Exec Summary, 2nd par.	In order for the Datalink Roadmap to be of any practical use, due account must be made of the current plans of the ATS providers to upgrade their infrastructure to implement ATS Datalink applications. It is recommended that presentations are made to each of the major Air Traffic Service providers (decision makers of) in Europe of the proposed application Roadmap in order to solicit feedback, the result will be a far more useful and practical basis to work from than the "clean sheet" of paper approach that appears to have been used.	FUTURE ACTION
22	SITA	6	Exec Summary	Exec Summary, ATM Application Roadmap, 1st par.	<p>"Another important driver, with the potential to offset the necessary costs of investment in new infrastructure, relates to the provision of additional capacity. Without additional capacity, the cost of delays and failure to accommodate demand will lead to rapidly escalating costs for the industry."</p> <p>Has a link been established between each proposed application and resulting increase in capacity, e.g. as in the case of the Link2000+ C/AFT analysis where a direct relation between equipage and delay was forecast ?</p>	Re-use of Link2000+ within this study
23	SITA	1	Exec Summary	Exec Summary, Datalink Roadmap	<p>"It is however noted that serious questions over the ability of both VDL2 and 1090 ES to support the requirements beyond 2010 still remain unanswered and need further consideration by the Community."</p> <p>This sentiment is repeated a number of times in the study and is based on an outdated EUROCONTROL ST15 study. In order to assess the capability of these technologies to meet the requirements beyond 2010 it is necessary to have a clear and definitive vision of these requirements. With respect to VDL2, given that step 1 is unlikely to realistically be in "widespread" use until 2010 it would be reasonable and realistic to assume that Step 4 would not be taken until at least 2014. The main concern aired in the study report appears to be over the number of frequency channels that would be required by VDL2 and the outdated Eurocontrol ST15 study appears to be the primary basis of this judgement. The study does not, however, analyse the channel requirements for the alternative technologies such as VDL4. Also please refer</p>	Conclusions are not drawn just on ST15. Channel requirements are analysed for all VHF channels
24	SITA	6	Exec Summary	Exec Summary, Datalink Roadmap	<p>The need to accelerate roadmap timescales to provide sufficient capacity to meet demand</p> <p>The study has shown that the roadmap presented above can only just meet the increased traffic demand during the next 15 years.</p> <p>Specifically:</p> <ul style="list-style-type: none"> <li>· it is unlikely that sufficient capacity will be provided to make any impact on the current high rate of delay experienced by air travellers in Europe;</li> </ul> <p>The Link2000+ C/AFT cost/benefit study has demonstrated significant capacity increases with wide-scale deployment of CPDLC.</p> <p>To what extent does the Datalink Roadmap study factored in the result of the Link2000+ C/AFT study results ?</p>	Both Link2000 and C/AFT study have been used in delivering the roadmap.
25	SITA	2	Exec Summary	Exec Summary, Datalink Roadmap	<p>Any shortfall in capacity can only be met by an increase in sectorisation, which in turn increases the costs of ground infrastructure and the need for additional VHF channels.</p> <p>To what extent has the expansion availability of additional 8.33 channels been factored into the study ?</p>	Not considered

26	SITA	2	Exec Summary	Exec Summary, Datalink Roadmap	The study has concluded that the number of VHF channels needed to support the operation of VDL2 during step 4 is too high as to be accommodated within the currently planned allocation of VHF spectrum. How many channels are assumed ? What is too high ? What was the basis of deducing this number of channels ? How is it proposed that alternatives such as VDL3 or VDL4 will be more efficient in using a less number of channels than those assumed to be required for VDL2 ? The timescale for Step 4 is 2009 – however, VDL3 would only have been introduced for digital voice in the USA, if at all, and is not foreseen to be introduced for Datalink until 2012. If VDL3 is deployed by the FAA to support Datalink it will be as a complementary to VDL2. The case for introduction of VDL3 in Europe will need to factor in the advantages of digital voice as compared to 8.33 voice/VDL2 for data. How many channels are foreseen to be required by VDL4, which SITA understands as a minimum requires 2 GSC plus one for each application supported.	See TA and Datalink Roadmap
27	SITA	1	Exec Summary	Exec Summary, Datalink Roadmap	To what extent has consideration been taken of the safety risks associated with relying on VDL4 to support both communications and surveillance ? By the time that step 4 arrives it would be reasonable to assume that the majority of aircraft operating in Europe will be VDL2 equipped and the simplest solution to create additional capacity (if required) will be to allocate additional channels as opposed to requiring the entire fleet to upgrade to VDL4 which may in the end also require an equivalent number of channels.	Noted
28	SITA	2	Exec Summary	Exec Summary, Datalink Roadmap	With the intended rationalisation of European airspace in the context of the SES, coupled with the availability of additional channels through 8.33 (theoretical total of 760 x 3 = 2,280 channels) expansion it would be worthwhile to study the number of frequency channels that could be made available to Datalink communications.	FUTURE ACTION
29	SITA	2	Exec Summary	Exec Summary, Datalink Roadmap	The disadvantages of this solution include the additional cost of the second link and the need to solve a number of technical problems, not least the integration of VDL2 and VDL4 on the same airframe. Are any interim results of the Eurocontrol sponsored study on VDL4 airframe issues available and will they be reflected in the Roadmap when formally released ?	FUTURE ACTION
30	SITA	1	Exec Summary	Exec Summary, Datalink Roadmap	A further objection to both VDL3 and VDL4 is that they compete with the spectrum allocation for VDL2, although it should be noted that both of these provide substantially higher data rates on a channel. What is the basis of this statement ? The raw throughput of VDL2 and 3 is 31.5 kbits/sec as compared with VDL4 which is 19.2 kbits/sec. SITA trials have measured actual throughputs at around 12 – 13 kilobits/second per aircraft.	Added
31	SITA	7	Exec Summary	Exec Summary, Datalink Roadmap	There is also a level of support by some operators and service providers for alternative solutions in steps 1, 2 and 3 based primarily on VDL4 and, in particular, for regional AT operations, GA and military. Please elaborate on which serious service providers and operators support VDL4 for communications and why.	Added to TA, DR
32	SITA	7	Exec Summary	Exec Summary, Datalink Roadmap	The driver for this scenario relies on providing lower cost avionics for these operators exploiting the ability of VDL4 to provide broadcast and point to point services. Note that further work and a clear industry sponsor is required to demonstrate that low cost solutions could be provided. SITA understands that the EC has made significant investment in VDL4 development, as reported at the ADS-B Symposium in Rome in 2002, as opposed to VDL2 development that has been funded by the service providers on a sound business case. On-going public funding of VDL4 development is considered to provide an unfair and anti-competitive advantage to the VDL4 industry. If VDL4 technology has a role then investments should be made by the supporting industry that sees the potential benefits of continuing its development.	Noted

33	SITA	3	Exec Summary	Exec Summary, Datalink Roadmap	Given the potential role of VDL4 providing a technical solution for steps 4 and 5a of the roadmap, it is recommended that the potential for some regional operators equipping directly with VDL4 is not discounted at this stage, and that further consideration is given to this in the consultation phase of the study. SITA is not aware of any serious commercial service provider offering VDL4 services or of any airlines that have committed to invest in VDL4 technology. SITA expects that regional operators will equip with Datalink technology which provides benefits and for which services clearly need to be made available. If "further consideration" concludes that regional operators equip with VDL4 how is it envisaged that the required infrastructure to be deployed on the ground and in the aircraft be funded? Clearly if public funds are to be made available to support Datalink development they should be shared fairly and equally between all technologies foreseen to be required.	Comm4 solutions
34	SITA	2	Exec Summary	Exec Summary, Datalink Roadmap	rationalisation of VHF spectrum. The VHF spectrum reserved for aviation use is in desperately short supply. To what extent has this been alleviated, and will be further alleviated with 8.33 and expansion coupled with the rationalisation of airspace in the SES context that should reduce the demand on required number of channels?	It was not. Alleviation is unlikely, voice use will always dominate until DSB-AM is replaced.
35	SITA	2	Exec Summary	Exec Summary, Datalink Roadmap	· validate the performance of the technologies, notably the VHF channel requirements of VDL2 A likewise study should also be recommended for VDL3 and VDL4. With the increasing dependence of ATS on Datalink it is inevitable that additional channels will eventually be required irrespective of the technology chosen.	Agreed
36	SITA	7	Datalink Roadmap	4.1.2.1 - 1st bullet	Replace AVPAC with VHF	Done
37	SITA	7	Datalink Roadmap	4.1.2.1 - 2nd bullet	FANS 1/A is also supported by VHF ACARS	Done
38	SITA	7	Datalink Roadmap	4.2.1	AMSS - over 2000 SITA customer a/c are equipped with SATCOM avionics.	Added to Annex E of TA
39	SITA	1	Datalink Roadmap	4.2.1	VDL2 - according to SITA analysis and experimentation the effective data rate is in the region of 12 - 14 kilobits/second	Noted, general comments added on this and further discussion at workshop.
40	SITA	2	Datalink Roadmap	4.2.1	VDL2 - the "several frequencies" referred to are not a discriminating factor since any VHF technology that is used for providing the backbone of ATS air/ground comms in high density European airspace will require a number of channels.	Note added
41	SITA	3	Datalink Roadmap	4.2.1	VDL3 - clarification should be made that VDL3 is, subject to meeting NARC Criteria, expected to be initially deployed to provide digitised voice for high altitude en-route airspace in the 2009 timeframe. The FAA does not expect to introduce VDL3 for data until around 2012	Added
42	SITA	3	Datalink Roadmap	4.2.1	VDL3 - last bullet - meaning of this statement is not clear. As far as SITA is aware there are no European plans to introduce VDL3	Added
43	SITA	3	Datalink Roadmap	4.2.1	VDL4 - 1st bullet - & 4.3.1.1 - vdl4 - a clear statement as to whether or not VDL4 has been validated to support end-to-end comms in an ATN context should be stated including the availability of relevant avionics (CMU s/w, VDR etc)	Added
44	SITA	3	Datalink Roadmap	4.3.1.1	"VDL4 could be in widespread operational use" - this implies that the only blocking factor for VDL4 is frequency availability which is simply not true. Is it really possible to conceive that if the required channels (TBD how many !!) were made available then 75% ACCs and a/c in Europe could equip with VDL4 by 2006 ????	Noted
45	SITA	3	Datalink Roadmap	4.4.2	Step 1 - On what basis is VDL4 included as a candidate for initial applications?	Credible ADS-B media
46	SITA	3	Datalink Roadmap	4.4.2	Step 2 - please provide the reference for the "recommendation"	Added
47	SITA	8	Datalink Roadmap	4.4.2	Step 4 - Neither VDL 3 or VDL 4 are realistic candidates for this step if one was to believe the over optimistic timescale of 2006. However, as previously indicated, a realistic timescale for initial step 4 would be 2012 by which time "widespread operational use" is feasible and will be based on VDL2. The question is whether one can seriously imagine the ATS and a/c operator community starting a migration to VDL3 or 4 at this stage. For example SAS, one of the leading European carriers to decide a fleet wide equipment would only have completed the process in 2010.	Noted, Step 4 is post 2010. VDL2, 3 and 4 should all be considered. Doubts expressed over VDL2 ability to meet QoS requirements.

48	SITA	8	Datalink Roadmap	4.4.3 Table 4-5	By having VDL2 or VDL4 together in for scenarios E & F confuses the analysis. Separate scenario should be defined with one technology per scenario.	No, the intention of the scenario is combinations of technologies
49	SITA	8	Datalink Roadmap	4.4.3	From SITA's perspective the most practical scenario is VDL2 for step 1, Mode S for step 2, Mode S for step 3, VDL2 for step 4, Mode S for step 5A - was this considered as a potential scenario ?	No, Mode S has been proven not to meet requirements for Step 5,
50	SITA	9	Datalink Roadmap	4.4.6	It makes no sense to completely cost VDL2 deployment as it is a technology that is being funded by the service providers to support AOC and only the additional cost of meeting ATS requirements (to be determined) needs to be considered, whereas other technologies such as VDL4 will be required to be funded specifically to support VDL4. Exceptionally, however, SITA has recently entered into a partnership agreement with AENA whereby AENA will procure from SITA initially 21 VDL2/ACARS stations in which case cost is an issue. However, this AENA investment is subsidised significantly as SITA will be a major user of this service to support AOC and AENA can expect to pay off the investment by the time of step 4.	Noted, however, these were the agreed criteria.
51	SITA	2	Datalink Roadmap	4.5.2.1	Step 4, 1st bullet - the required number of channels is driven by the ATM application requirements this needs to be made clear. VDL4 is more than likely to require even more channels than VDL2 due to the need for GSCs. As already suggested, this discussion is really academic since there will need to be an impelling business case for the airlines, having invested huge amounts in upgrading to VDL2, to migrate to VDL4. It is recommended to solicit the views of the major European airlines regarding migration from VDL2 to VDL4 for data communications.	Noted, but also see other comments
52	SITA	7	Datalink Roadmap	4.5.2.3	Since VDL4 is proposed as an alternative for VDL2 in step 1 is it fair to assume that no further RTD actions re.VDL4 are required ?	Not fair to assume this for either.
53	SITA	7	Datalink Roadmap	5.1.4	Please elaborate and justify on the "serious questions".	Footnotes pointing to TA added
54	SITA	1	Datalink Roadmap	5.2.4.2	The ST15 is outdated and obsolete. As indicated in the SITA comments on the exec.summary, SITA today operates with 3 channels in Europe that exchange on the order of 7 million kilobits/month. A VDL2 channel will provide 10 times the capacity => 3 VDL2 channels will enable the exchange of 70 million kilobits/month. Six channels will therefore provide the capability to exchange 140 million kilobits/month which SITA considers is more than adequate to support both the forecast increase in AOC data exchange and planned ATM applications. Experience has shown that VDL2 is capable of around 12-15 kilobits/second.	Information added to TA.
55	SITA	1	Datalink Roadmap	5.2.4.5	VDL3 will require specific frequencies for each sector, each channel providing 3 or 4 circuits that can be used for either voice or data.	Disagree for 3T which is being discussed
56	SITA	7	Datalink Roadmap	5.2.4.10	The concept of the ATN implies that changes in underlying g/g and a/g technology will not require any changes to the CWP and/or FDP.	Disagree, the new applications will require CWP and FDP changes
57	SITA	3	Datalink Roadmap	5.3.1	Please quantify "level of support" and identify the "operators". How close are regional operators to making investment decisions to equip with VDL4 ? To date, SITA is not aware of any airline that has committed to implementing VDL4 nor of any service provider deploying the service on the ground.	Evidence added.
58	SITA	7	Datalink Roadmap	5.4.3	Please quantify "serious technical concerns" and present how alternative solutions can alleviate such concerns.	See previous
59	SITA	7	Datalink Roadmap	5.4.7	Please provide reference to a Eurocontrol statement supporting the claim in 5.4.7	Statement changed
60	SITA	1	Datalink Roadmap	5.4.8 3rd bullet	The sentence implies that VDL4 has no concerns on channel requirements. This is simply not true and the statement needs to be re-worded to provide a balanced view.	Agreed, change added

61	SITA	6	Datalink Roadmap	5.4.8 5th bullet	It has been suggested that VDL4 be an alternative for step 1 and that regional operators may decide to equip - if so then one assumes that there are no remaining outstanding technical issues wrt VDL4. Therefore why are further studies recommended? A huge amount of public funds have already been spent on VDL4 and it is about time that those who promote its use invest directly to make it a reality without placing further demands on public funding. VDL2 has in large been funded by the service providers with relatively little, if zero, contribution of public funds since it has a business case.	Noted
62	SITA	9	Datalink Roadmap	6.2.5	Table 6-1, Since VDL2 deployment is funded by the service providers there is no value in assessing the costs of this technology in this study. The table suggests that a 2nd transceiver is \$60K, this is 200% more than reality. Table 6-2 - Did the study take into account the results of the US CPDLC Benefits Study which provided accurate figures from all major avionics vendors for CPDLCATN/VDL2 - it is highly recommended that the results of that study are analysed and reflected here.	Agreed.
63	SITA	1	Datalink Roadmap	6.3.1 2nd bullet	Again, the presumption that VDL2 requires an excessive no. of channels when alternatives can do the same job with less is seriously flawed!	Noted,
64	SITA	1	Datalink Roadmap	6.3.10	As above.	Noted
65	SITA	3	Datalink Roadmap	6.3.13	Based on current knowledge, it is highly questionable that even by 2008 75% of the Eur fleet will be ATN/VDL2 equipped.	Noted
66	SITA	9	Datalink Roadmap	6.4.1 4th bullet	Since the communications service providers and airlines are making significant investments in VDL2 for AOC that will be leveraged to support ATS applications it is essential to make provision of this discount in the CBA.	Footnote added
67	SITA	1	Datalink Roadmap	6.4.5 & 6.4.7 3rd bullet	Due consideration must be made regarding the potential consequences of using a technology such as VDL4 to support both ATS datalink communications and surveillance services. This is a MAJOR safety issue that must be addressed.	Added
68	SITA	2	Datalink Roadmap	6.4.7 3rd bullet	Again, the "spectrum shortage" and argument that VDL2 requires "too many" channels is presented. A like for like comparison is required for all technologies that are required to support a specific set of ATM applications. The entire case made against VDL2 is predicated on the spectrum demand, thereby if it was proven that VDL2 will be capable of meeting the required demand the case for VDL4 implementation for comms disappears. Is this a fair statement?	Yes
69	SITA	3	Datalink Roadmap	6.5.3 & 6.5.12	Which department in Eurocontrol proposed VDL4 for comms in Step 4? Such statements need to be clearly referenced as SITA understands that there are no Eurocontrol plans to implement VDL4 for comm. SITA would be interested to review Eurocontrol's comments on the Roadmap.	Comms Unit. All comments have been provided
70	SITA	7	Datalink Roadmap	6.5.6 & 6.5.14	Please elaborate on the "significant technical issues" regarding VDL4.	Added refs
71	SITA	7	Datalink Roadmap	6.5.6	It is stated that regional operators may decide to equip with VDL4 - wrt ADS-B SITA understands that all aircraft will need to be equipped in order to present a complete CDTI to the pilot thereby enabling benefits. How is it anticipated that ADS-B related benefits with a limited implementation of VDL4 will accrue?	Point-to-point does not require 100% equipment. ADS-B on two links requires TIS-B, as envisaged by the FAA. We have included the appropriate costs
72	SITA	1	Datalink Roadmap	6.5.7	The assertion that VDL2 data rates are "very low" is incorrect, as previously indicated VDL2 will support rates of around 12 - 14 kilobits/second as substantiated through SITA trials and analysis.	Noted
73	SITA	2	Datalink Roadmap	7.1.1 3rd bullet	The assertion that datalink comms will result in more efficient sectorisation and therefore a reduction in requirements for additional channels is an extremely valid point. Whichever technology is deployed will enable this efficiency and will in turn be in a position to utilise the freed spectrum to deliver further benefits. This is a strong argument in favour of retaining VDL2 for Step 4 since by that time additional channels would have been freed up.	Noted

74	SITA	2	Datalink Roadmap	7.3.3	All 4 VDL2 channels will simultaneously support AOC and ATS - otherwise there will be a requirement for a dedicated radio for each service. As indicated earlier SITA today operates only 3 ACARS frequencies in Europe exchanging on average 7 million kilobits/month. Since VDL2 will provide 10 times the capacity, 3 VDL2 channels will support the exchange of 70 million kilobits/month. The study should identify the required ATM application data exchange as one means to validate up to which point VDL2 will be in a position to meet requirements with 4 channels.	Added to Annex F of TA
75	SITA	6	Datalink Roadmap	7.4.5	With respect to decision makers in ANSPs, it should be noted that the CANSO has developed a recommendation on Datalink implementation, this paper needs to be referred to an the recommendations of the CANSO study need to be consolidated with the Roadmap.	Reference has been added
76	SITA	8	Datalink Roadmap	7,5	As indicated earlier, the timescales are far too optimistic. For the Roadmap to be of any value it must reflect reality and not be designed with a "clean sheet of paper" approach which more or less appears to be the case.	
77	SITA	3	Datalink Roadmap	7.5.8	The statement is simply not true. SITA is aware of a number of airlines that will retro-fit with VDL2 - including the 40 pioneer aircraft of LH and SAS !	Added
78	SITA	7	Datalink Roadmap	7.7.3	Presumably ARINC will comment on this para.	Yes
79	SITA	6	Datalink Roadmap	7.7.4	If the Eurocontrol study concludes that VDL2 will be capable of supporting the requirements foreseen for Step 4 one would question the value of spending further funds on assessing the capability of VDL4 as there would be no case to implement it.	Possibly
80	SITA	6	Datalink Roadmap	7.7.6	There is already an industry decision on datalink and that is VDL2. Why does this Roadmap study continually promote VDL4 ? A further example is shown in the 1st bullet of par. 7.7.6 where it is stated that demonstrate the current limitations of VDL4 can be overcome - maybe they cannot ! If industry sees value in pushing VDL4 then they should fund the work and not rely on further public funding. It was reported at the ADS-B Rome Symp. last year that tens of millions of euro's have been spent on VDL4.	Noted
81	SITA	2	Datalink Roadmap	7.10.1.1	This par. states that the "study has concluded" (i.e. VDL2 requires too many channels !!) whilst 7.7.4 refers to a Eurocontrol study on this subject.	Noted
82	SITA	6	Datalink Roadmap	7.10.1.4 2nd bullet	Again - this par. and some others in the study as a whole gives one the impression that VDL4 is a perfect and working solution just waiting to be implemented for step 4 - this should be changed to reflect reality.	Agreed, more added
83	SITA	6	Datalink Roadmap	7.10.1.4 4th bullet	I did not see the a description of the technical issues surrounding VDL4 in this RoadMap document, a section should be included and also a summary provided in the Executive Summary in order to provide an objective and balanced perspective.	Added
84	AIRBUS	6	General	General Comments	VDL4 IS VERY WASTEFUL OF SPECTRUM VDL3 and VDL4 transmit at frequent intervals, whether there is useful information to be sent or not.	Noted
85	AIRBUS	2	General	General Comments	They transmit in the VHF Com band, where with the widest antenna spacing you can get on an airliner, you need 6MHz spacing from the nearest voice, ACARS or VDL2 frequency to avoid interference, per ARINC 716 para. 3.6.7.4 and ARINC 750. You don't need this spacing with ACARS or VDL2, because they transmit infrequently and sporadically, making interference sporadic and unimportant.	Noted, 2SW agreed that 6Mhz was between DSB-AM and all VDLs
86	AIRBUS	2	General	General Comments	This means that you need a 6MHz guard band with VDL3 and VDL4, wrecking any claims to spectrum efficiency. Unfortunately, this spectrum inefficiency makes them unsuitable for installation on an aircraft, for anything other than experimental use on limited route structures, unless you change the other VHF radios on the aircraft to something which has not yet been invented. This is why it is necessary to discontinue their envisaged use on aircraft, thus changing the draft conclusions of the study.	Noted, 2SW agreed that consideration of DSB-AM Radio modernisation should be considered.
87	AIRBUS	4	General	General Comments	There is likely a lot of value in the VDL4 protocol, were it to be applied where this interference issue is different, such as L-band, as used by UAT.	Noted

88	AIRBUS	7	General	General Comments	TIS-B HAS NO SUPPORTING DATA Although TIS-B has much conceptual merit and experiments are taking place in various places, no work has been published so far showing that it works, and what its limitations are. Consequently, any mention of its use must be qualified with an appropriate note.	Footnote added
89	AIRBUS	6	General	General Comments	INCOMPLETE INTRODUCTION OF AIRBUS COMMENTS There is also an issue of form which is of concern. Although the previous Airbus comments were quite well incorporated at the beginning of this version, as one went through the document, this good work did not continue. This left the impression of a document which had been selective in its use of the truth, favouring one technology unjustifiably. It was also wasteful of Airbus time, since we had to transfer them all from the previous document to this one. I am confident you will be able to reassure me that this was inadvertent, and due to lack of time, and that you will incorporate the comments before the public meeting. Please feel free to change the words, so long as they mean the same. If you are unable to see the reason for a comment, or have information which makes you think it is inappropriate, please call me or e-mail me, and I'll try to look at it when I get back to the office.	A further attempt has been made to incorporate AIRBUS comments.
90	AIRBUS	All	Datalink Roadmap	Airbus specific comments	Airbus comments consisting of red-line (inserted) text is contained in a copy of the roadmap document (see the separate file). Below are the non-red-line comments (stand-alone text) extracted from that document.	See above
91	AIRBUS	8	Executive Summary	Data link roadmap	Delete VDL4 from Step 5a Continue AOA and VDLM2 operation with near-horizontal lines – they'll stay in use. State new systems are for voice and data-link.	No. VDL4 is an option for 5a. Diagrams reflect ICAO policy.
92	AIRBUS	8	Executive Summary	The potential need for...	Use near-horizontal tapers for AOA and VDL2	Diagram reflect ICAO policy
93	AIRBUS	4	Executive Summary	Role of VDL4	The problem with VDL 4 is that is in a part of the spectrum which it would affect adversely. Use of the VDL 4 protocols in a new system in another part of the spectrum could, however, be very promising.	Noted
94	AIRBUS	1	Datalink Roadmap	3.4.2	Note also that although TIS-B is conceptually attractive, there is no significant published documentation on research showing TIS-B performance, or showing that TIS-B works.	Added
95	AIRBUS	8	Datalink Roadmap	3.5.1 Step 4	This is known airborne technology	Agreed
96	AIRBUS	8	Datalink Roadmap	3.6.1	You will need to put 5b much earlier than 5a – the airborne technology is known for your 5b, but not for 5a	
97	AIRBUS	8	Datalink Roadmap	3.6.2	However, spacing in the core area is expected to be economically viable, whereas self-separation in the less dense areas is not expected to be economically viable due to the low amount of traffic and added expense of the higher-integrity avionics needed for all participating aircraft.  Much more research is needed for the airside for this step.	Some added
98	AIRBUS	2	Datalink Roadmap	4.2.1 VDL3	VDL3/ATN does not support long term goal of tactical datalinks, due to VHF spectrum saturation.  Because of the wide guard bands needed for airborne use, VDL.3 is very inefficient of spectrum use.	Issue is lack of QoS for VDL2
99	AIRBUS	2	Datalink Roadmap	4.2.1 VDL4	VDL4/ATN does not support long term goal of tactical datalinks, due to VHF spectrum saturation. Because of the wide guard bands needed for airborne use, VDL.4 is very inefficient of spectrum use. VDL4 is very expensive to install on airliners	Issue is lack of QoS for VDL2, discussion of 6MHz guard band added
100	AIRBUS	3	Datalink Roadmap	4.3.1.1 1090 ES	All large airliners (about 100 seats and more) are being equipped with updated Mode S transponders starting 2003, with fleetwide retrofit complete by 2005, to comply with Mode S rules. These transponders also perform Mode S Enhanced Surveillance and 1090 Extended Squitter ADS B functions, which are being certified at the same time. An ADS-out solution will extend the life of the Mode S link by reducing the need for frequent interrogations by ACASs and MSSRs.	Added
101	AIRBUS	3	Datalink Roadmap	4.3.1.1 VDL4	VDL4 is the most expensive of the proposed systems to install on an airliner. The need for wide guard bands makes VDL4 very inefficient of spectrum use. VDL4 has been rejected by the US, and is not a worldwide standard.	Discussion added

102	AIRBUS	3	Datalink Roadmap	4.3.1.1 UAT	UAT has been selected by the US, and is potentially a world-wide standard.	Added
103	AIRBUS	2	Datalink Roadmap	4.4.7	This para needs revisiting – and the cost of airborne VDL4 installations is very high due to retrofit of innovative antenna positions.	Noted
104	AIRBUS	2	Datalink Roadmap	4.5.2.1 Step 4, 2nd bullet	Would it significantly improve or degrade the situation, given that VHF spectrum use expansion is dominated by voice needs?	Added
105	AIRBUS	8	Datalink Roadmap	4.5.2.1 Step 5, 2nd bullet	There is no evidence yet to support this.	Comment considered in Section 5
106	AIRBUS	8	Datalink Roadmap	4.5.2.1 Step 5	In other words, which future surveillance technologies should be deployed to support the long-term (2015+) requirements?	Yes
107	AIRBUS	1	Datalink Roadmap	5.2.5.1 1st bullet	However, TLAT did not take into account the lower interrogation rates that MSSRs and TCASs could use with 1090ES, extending traffic handling ability	This comment has been used elsewhere. TLAT did not agree with it.
108	AIRBUS	9	Datalink Roadmap	6.2.3 Costs	You should put in the Boeing figures too –they should be available now.	Noted
109	AIRBUS	9	Datalink Roadmap	6.2.5 Costs	Costs for Mode S ES and 1090ES should assume the transceiver exists on Airbus & Boeing aircraft	Noted
110	AIRBUS	7	Datalink Roadmap	6.3.2	The growth curve should be near-exponential, not straight, in this & following figures.	
111	AIRBUS	8	Datalink Roadmap	6.5	VHF spectrum should also show voice use, and the tapers should be near-horizontal rather than near-vertical – airlines can't afford to buy new equipment that fast, in this figure and those below.	Noted
112	AIRBUS	8	Datalink Roadmap	7.5.4	Air carriers operating in Europe will need other voice and data links from around 2015, when the VHF spectrum and the 1090 frequency are expected to become saturated.	Yes
113	AIRBUS	7	Datalink Roadmap	7.8.1.1	Confidence building measures to re-assure airlines & air traffic service organisations that improved ATM will in fact result.	Added
114	AIRBUS	7	Datalink Roadmap	7.8.3.2	They should redirect this work to address 1090 ES.	Noted
115	DFS	6	General	General comments - Comments from Managing Directors Ralph Riedle and Peter Waldinger	I would first of all like to thank you for providing the DFS with the opportunity again to review the progress of the data link roadmap study. In consideration of the recent holiday season, and the amount of material available from the consortium, I would like to ask for your understanding that our current review could mainly be focused on the document "Data Link Roadmap -Summary" only, which you distributed on December 20, 2002.	Agreed
116	DFS	6	General	General comments	In summary, the DFS would like to express its overall support for the data link roadmap as described in the summary, fully recognising that	Agreed
117	DFS	6	General	General comments	- the introduction of ATM functions supported by data link is one of the cornerstones needed to provide for increased capacity;	Agreed
118	DFS	6	General	General comments	- the timescales for the various steps are, and should remain, of a strategic nature, and will unavoidably be challenged by reality (standardisation processes, e.g. at ICAO, decision-making processes, development and certification processes, etc.);	
119	DFS	6	General	General comments	- further work is needed along the various recommendations of the study, in order to validate the underlying assumptions, clarify the various RTD issues identified, and review/refine the cost-benefit-analysis.	Noted
120	DFS	1	General	General comments	Having only reviewed the Summary Document thoroughly we were unable to recognise whether the study has also analysed the impact that current and emerging security requirements might have on the development, certification and implementation of data link applications, and thus on the data link roadmap itself.	It has not
121	DFS	3	General	General comments	Specific comments; The study very rightly points out that just recently a number of significant decisions, recommendations and consensus building has been achieved by the aeronautical community in support of the implementation of 1090 ES and Mode S EHS. We would like to highlight the importance of these achievements. Even further, we would like to stress the resulting window of opportunity for the community for an early and economic introduction of initial ADS-B capabilities.	Noted

122	DFS	1	General	General comments	Step 1 of the roadmap describes the data link applications and enabling technologies in a short-term perspective. When reviewing the applications identified by the study for this phase, and comparing them with the scope of LINK 2000+ as the only current European data link implementation programme, we recognised that some of the applications identified by the study (e. g. D-RVR) are, for various reasons, outside the scope of LINK 2000+ and outside the current ECIP and corresponding LCIPs.	Noted (I have not changed the application set as this would entail a lot of work, I have added a foot note to the effect of this comment)
123	DFS	4	General	General comments	One of the technical options identified by the study is to directly move from a VDL2/8.33 kHz environment to a solution based on emerging broadband technologies, skipping any other intermediate technological step. Offering the opportunity to avoid additional effort and cost, and "simplifying" the roadmap, that option generally appears to be very attractive and could be supported by DFS, provided feasibility in the proposed timeframe can be proven.	Noted - if feasible it is the best option, but it is currently considered risky.
124	DFS	3	General	General comments	As Europe is facing the challenge to provide a substantial increase of airspace capacity until 2020, DFS is convinced that introduction of data link can be only one of the cornerstones to provide the envisioned goal. Naturally a roadmap for data link puts emphasis on one solution, but we would like to put it into a broader framework as introduced by Eurocontrol ATM 2000+ Strategy and the ensuing Strategic Performance Framework.	Noted
125	DFS	6	General	General comments	Finally we would support the idea of a further public consultation workshop in February 2003 and DFS will certainly participate in that event. Detailed comments on the Summary Document, the Data Link Roadmap and the Application Assessment will be sent to you in a separate mail.	Noted
126	DFS	6	General	Comments from DFS technical experts of business units Tower and Center Control	In general my impression of the document is good (structure, readability, references to other documents).	Noted
127	DFS	3	General	General about timescales	The timescales indicated in this document are optimistic. One should not underestimate the effort and time for certification and validation, as experience for these tasks in this context (data link technologies, air-ground integration) is low. Recommendation: Review the timescales under consideration of the timescale of appendix E (Community actions). If the action "stimulate equipage" is based solely on the Single Sky Unit and States and not driven by real economical benefits inside the air transport industry the process for getting a common approval will be a very long one.	
128	DFS	8	General	General comments	It is not clear, who takes responsibility about work packages and timescales. The air transport industry is reluctant in investing in parts of applications if the overall introduction (and return of investment) seems to be doubtful.	Noted
129	DFS	8	Executive Summary	ATM Application Roadmap	The study team states that the most urgent area for capacity enhancement is Terminal Airspace. The focus area of data link applications in other implementation programs (i.e. Link2000+) is the enroute airspace. This assumption is surprising. Traditionally the most limiting capacity constraint has been seen in runway capacity. Clarify, if there is a real capacity constraint in the Terminal Airspace or if this capacity constraint is a result of limited runway capacity.	Noted
130	DFS	7	Executive Summary	Diagram	The diagram is not very clear. There is a mix-up between commercial services (i.e. ACARS), data link technologies (i.e. VDL M2) and wrapper layers (i.e. AOA)	Noted - diagram is an ICAO one
131	DFS	10	Executive Summary	Appendix B Step 1, early a/g ATM applications	These early applications do not meet the postulated demand in Terminal Airspace: strategic clearances, oceanic downstream clearances	Noted
132	DFS	10	Executive Summary	APP1c Enhanced surveillance accuracy for automation tools	Automation and surveillance accuracy are different things. Processes can be automated under some circumstances (i.e. if the process is simple). Enhanced surveillance accuracy is no prerequisite for automation	Noted

133	DFS	10	Executive Summary	App2b Strategic controller/pilot messages	DCL should be noted as Departure Clearance not PreDeparture Clearance	Noted
134	DFS	10	Executive Summary	App2c Support for increased	That's no ATM application Delete this item or refine it	Noted
135	DFS	10	Executive Summary	App4a D-OTIS	ATIS is already delivered via data link (ACARS) and belongs (also) to strategic information. D-RVR is safety- and time-critical See also review of document "application assessment"	Noted
136	DFS	10	Executive Summary	App4a D-OTIS	The D-RVR service is time-critical. The certification process for this application didn't start. Recommendation: Time-critical services as D-RVR need a fast and reliable infrastructure. This should be considered for time planning.	Footnote added
137	DFS	10	Executive Summary	ATM Application Roadmap	The study team makes the assumption, that capacity and safety benefits are delivered mainly by different ATM applications using air/ground or air/air data link. Hence this assumption is reasonable, there are also other means to gain capacity and safety. Recommendation: The findings of the study should be considered carefully. Especially the recommended objectives and actions (Annex E) are one (but not the only one) way to overcome actual and future shortages in capacity and safety. Decisions for mandates should be based on a business case.	Noted
138	DFS	7	Datalink Roadmap	3.1.5	The term "ground centred trajectory planning" is unclear. Is it "trajectory prediction provided by ground ATM systems" which is considered? Clarify!	Yes it is
139	DFS	9	Datalink Roadmap	3.3 - 3.6	All capacity benefit numbers should be quoted as "derived from a simple model which needs independent validation" (see ref. document P167D1030)	Agreed
140	DFS	9	Datalink Roadmap	3.3.4, 1st bullet	Quoted capacity benefits of typically 27% cannot be correct, since the capacity gain is rated as "small" (e.g. around 5%) for all three applications APP1a, APP1b and APP1c in the reference document P167D1030, page 21. On page 85 of P167D1030 the 27% are quoted, but in the context of "conflict free trajectories" which would not be provided by APP1a/b/c. Rather APP1a/b/c would give some small contribution to the benefits of this concept.	
141	DFS	9	Datalink Roadmap	3.3.4, 4th bullet	Validation of the use of DAP is not a benefit, it is a prerequisite before using DAPs in ground system applications. To be deleted	Changed emphasis so as not to include as a benefit
142	DFS	9	Datalink Roadmap	3.3.5, 3.3.6	In the view of step 1, where a point-to-point datalink infrastructure has to be set up, using this infrastructure also for step 2 ATM applications, one could argue about step 2 to have the potential to avoid additional infrastructure costs. But there should be no statement about saving infrastructure cost, which would be misleading.	The cost saving is due to deployment of some chapter ADS B ground stations rather than Mode S ground stations.
143	DFS	9	Datalink Roadmap	3.5.3	The 8% capacity gain cannot be traced back to ref P167D1030	
144	DFS	8	Datalink Roadmap	3.6.2, last bullet	It should read : "Step 5a(!) for the core area and step 5b ....	Added
145	DFS	8	Datalink Roadmap	3,7	Table 3-1: APP13c should be included in step 4, as in written in Chap. 3.5	Added
146	DFS	3	Datalink Roadmap	3,8	Figure 3-1: General: Many dates don't agree with the figure on page 6 (especially step 3 and	
147	DFS	3	Datalink Roadmap	3,8	Figure 3-1: Step 1 dates, especially for "APP2b Operational" are not realistic in view of requiring 75% equipage of A/C and ground systems. At least for ground systems this equipage rate will be achieved only some years later	
148	DFS	3	Datalink Roadmap	3,8	Figure 3-1. Step 3 dates for provision of TIS-B in 2007 (APP3a-d) are not realistic	
149	DFS	3	Datalink Roadmap	3,8	Figure 3-1: Step 4 dates (2009-2010) don't seem realistic in view of requiring 75% equipage of A/C and ground systems	
150	DFS	3	Datalink Roadmap	3,8	Figure 3-1: Step 5B: APP1e and APP13b (ADS-B as sole means) is questionable	
151	DFS	9	Datalink Roadmap	6,4	General: The calculation of benefits (and therefore the comparison to the costs) is unclear. Explain!	
152	DFS	9	Datalink Roadmap	6,4	Small sensitivity of NPV in CBA for different scenarios (i.e. different time plannings) is a result which should be independently validated	
153	DFS	9	Datalink Roadmap	6,4	CBA should also be done for ANSPs, Airlines and other stakeholders separately!	

154	DFS	3	Datalink Roadmap	6,5	Airbus roadmap seems to be more realistic also for ANSPs than the original Phase 1 roadmap	
155	DFS	10	Application Assessment	Section 8.2.4 OC4: Provision of information to aircraft, app4a	Services D-ATIS, METAR and D-RVR don't have the same characteristics. D-ATIS typically is valid for 30 minutes (temporal coherence is low), but D-RVR is valid for 10 seconds (temporal coherence is high, time criticality is very high). The same goes for spatial coherence: D-ATIS is valid for one airport and the adjacent TMA, D-RVR is valid for a specific runway in use. Recommendation: Extract the service D-RVR from the other services and add the appropriate values in the table. This distinction should also be made in other parts of the document (chapter 3.2.5, time frame and needed characteristics of the data link technology). Consequences of unchanged implementation: unrealistic estimations about benefits and time frame. D-RVR can't pass safety assessment with this assumptions	
156	DFS	10	Application Assessment	Section 8.2.4 OC4: Provision of information to aircraft, app4a	D-ATIS service standard written by EUROCAE defines a subscribe/unsubscribe service for timely information about every new ATIS and a one-shot ATIS info. A real broadcast service to unknown recipients is not foreseen. Recommendation: Correct lines "Frequency" and "Information exchanged" Consequences of unchanged implementation: unrealistic estimations about message characteristics	
157	DFS	10	Application Assessment	Section 8.2.11 OC14: ATS in oceanic/remote area	Data link service DCL (departure clearance) does not belong to app14b Recommendation: Delete DCL in line "D/L services"	
158	DFS	10	Application Assessment	Section 8.1.6 The data Link Services description contains DCL service, but OC is missing	There is no operational concept for data link service DCL (the one given in this document, OC14, is definitely wrong) Recommendation: Add DCL in OC2, App2b (is there already in the description)	
159	DFS	10	Application Assessment	Section 8.2 Derivation of technical requirements from operational applications characteristics; context of "frequency"	It is unclear, which point of view is used. Example: the point of view of one aircraft regarding RVR is that RVRs are given sporadic. the point of view of an air traffic control unit is that RVR is given regular (at least one for every landing, in peak times nearly every minute). Recommendation: Clarify this issue. It may be relevant for the assessment which kind of data link is best suited for specific services. This depends also from the context: a point-to-point communication infrastructure may be adequate to the D-ATIS service in a low traffic scenario, in a high traffic scenario a broadcast infrastructure would be more efficient. Consequences of unchanged implementation: Unrealistic estimations about data volume. Communication architecture may not fit to future needs or specific areas (low traffic versus high traffic areas). Additional costs for service delivery	
160	DFS	10	Application Assessment	Section 3.2.3 APP2b: Strategic controller/pilot messages	It is not fully clear, which kind of clearances belong to app2b and which kind belongs to app14b	
161	Eurocontrol	6	General	General comments	Please note that due to the huge amount of information, Eurocontrol is only able to comment on this Volume (Data Link Roadmap - Summary) and does not provide comment on the other volumes of the referred study. This does not mean that Eurocontrol endorses their content.	Accepted

162	Eurocontrol	1	General	General comments	Please note, as a general remark, that the Eurocontrol study, used as reference in the report (i.e. COM.ET2.ST15 - Analyse options for Initial A/G data networks") was performed several years ago with the specific objective of providing worst cases information for decision making for a first step implementation. The performances were established based on theoretical calculation, using the system specifications available at that time and assuming basic operational scenario. Since the completion of the referred study, the considered systems have evolved and the real operational scenario are better defined. This would lead today to different system performances. Therefore, I would advise to be very careful when drawing conclusion based on the results of the referred study.	Only limited use of ST-15 was used, where possible other sources were used to verify facts, in some cases additional analysis is provided so as not to rely solely on ST-15.
163	Eurocontrol	8	General	General comments	I would also re-highlight the differences in interpretation of the milestones which, as we pointed out during our EC-Eurocontrol meeting, lead to apparent timeframe divergences with the Eurocontrol application roadmap.	
164	Eurocontrol	1	Executive Summary	3rd paragraph	"It is, however, noted that serious questions over the ability of both VDL2 and 1090 ES to support the requirements beyond 2010 still remain unanswered, and require further consideration by the Community"  This wording "serious questions" is misleading since it is known that VDL2 and 1090ES cannot go beyond their limit. I propose to replace this sentence with e.g. "For the introduction of Step 4 and Step 5, VDL2 and 1090ES would not support the QoS required by the related applications. New systems would have to be considered"	Added to DR and TA
165	Eurocontrol	1	Executive Summary	"Data Link Roadmap"	"The potential need for an additional VDL implementation to meet the requirements of Step 4"  It is difficult to definitively state that the required number of VDL M2 channels will exceed the spectrum capacity available. The only sources of information available are based on theoretical calculation done sometime ago (e.g. ST15 which had a specific objective to provide worst case information to provide decision making elements). Up to the availability of the simulation currently being developed, we have no certainty. Instead of capacity issue, it would be more accurate to talk about the inappropriateness for VDL M2 to support Step 4 applications in high density region (due to its non-deterministic QoS)	Noted, general discussion added
166	Eurocontrol	2	Executive Summary	"Data Link Roadmap"	"The potential need for an additional VDL implementation to meet the requirements of Step 4" paragraph  It is difficult for the time being to compare the spectrum efficiency and therefore the potential throughput capacity [Hz] of VDL M2, M3 and M4  One important factor of the equation is the real channelisation of each systems (including the number of guardband in all operational scenario)  Up to now, we only got definitive frequency implementation criteria figures for VDL M2.  For VDL M3, we simply do not get information.  For VDL M4, the first measurements were pessimistic. During discussions with avionics manufacturers, we defined an action plan targeting figures which would be acceptable to solve the spectrum implementation concerns. The Avionics manufacturers stated that the implementation of the targeted figures would be achievable. However, no proof of evidence has been yet provided	Noted, general discussion added to TA
167	Eurocontrol	2	Executive Summary	"Data Link Roadmap"	"The potential need for an additional VDL implementation to meet the requirements of Step 4" paragraph  Propose to replace "not least the integration of VDL2 and VDL4" with "not least the integration of analogue voice VHF, VDL2 and VDL4"	Exec Summ only
168	Eurocontrol	3	Executive Summary	"Data Link Roadmap"	"The potential need for an additional VDL implementation to meet the requirements of Step 4" paragraph  Second diagram. If this diagram refers to the Eurocontrol consider roadmap, VDL M3 should not be in.	Noted
169	Eurocontrol	3	Executive Summary	Role of VDL4	Consideration of VDL4 by military for cost reasons is an unlikely development	Added to DR and TA
170	Eurocontrol	2	Executive Summary	Role of VDL4	Among reasons of opposition to VDL4 is also the cosite problem that the integration of VDL4 in addition to voice and VDL2 is posing.	Noted, general discussion added

171	Eurocontrol	2	Executive Summary	Role of VDL4	The main issues for VM4 that need to be addressed and answered are: Integration on the a/c (e.g. cosine issue) Validation of feasible frequency planning criteria	Noted, general discussion added
172	Eurocontrol	2	Executive Summary	"Data Link Roadmap" Other necessary actions include	"Validate the performance of the technologies, notably the VHF channel requirements of VDL2." addresses two separate issues, which are not only related to M2. I propose to cut into 2 bullets: Validate the performance of the technologies, Define the VHF channel requirements.	Added in DR and TA
173	Eurocontrol	4	Executive Summary	"Data Link Roadmap" General comment	The Eurocontrol and AMCP WG C proposed roadmaps include 2 proposed alternatives for new systems operating outside the VHF band: 3G-based and Next Generation Satellite based system. The last one is not reflected in the summary	Noted
174	Eurocontrol	7	Executive Summary	Acronym	The ICAO definition of VDL is VHF Digital Link	Done
175	Eurocontrol	8	Executive Summary	"Assessment of data link technologies supporting point to point services" Table	This sentence "VDL2/ATN is likely to be the first real continental ATC datalink, but will require several frequencies". The second part if true for every system and shall be either deleted or added for each system The non support of step 4 datalink service in low density airspace has not been demonstrated	Done
176	Eurocontrol	3	Executive Summary	"Assessment of data link technologies supporting point to point services" Table	VDL Mode 4 is not yet officially standardised. for Com services. AMCP 8 is expected to state about	Updated
177	Eurocontrol	2	Executive Summary	"Assessment of data link technologies supporting point to point services" Table	VDL Mode 4 : risk for on board feasibility integration and acceptable frequency implementation criteria should be identified	Added
178	Eurocontrol	4	Executive Summary	"Assessment of data link technologies supporting point to point services" Table	NGSS : this is not the fact that they support NGSS services which contribute to financial difficulties. Financial difficulties are coming from the fact the providers are "sailing" general-public services	Added
179	Eurocontrol	4	Executive Summary	"Assessment of data link technologies supporting point to point services" Table	SDLS is one of the potential NGSS SDLS: Eurocontrol is not sponsoring SDLS. Eurocontrol is progressing a Next Generation Satellite System definition re-using some concept identified by SDLS	Added
180	Eurocontrol	4	Executive Summary	"Assessment of data link technologies supporting point to point services" Table	3G: should it not be step 5?	Yes
181	Eurocontrol	2	Executive Summary	Annex C2 VDL2	"The effective data rate for VDL2 is of order 3000 bps for en-route airspace (see technology assessment document P167D2020 Annex F for a discussion of this data rate)."	Agreed
182	Eurocontrol	2	Executive Summary	Annex C2 VDL2	It is reminded that the ST15 had a specific objective (to provide decision making elements for a first step deployment based on theoretical calculation in the worst cases – non assumed to happen in the operational life. For instance, the data rate was evaluated for en-route and terminal using a single frequency, without taking FEC into account ...	Noted, ST15 is now not used as the first estimate
183	Eurocontrol	2	Executive Summary	Annex C2 VDL2	Eurocontrol is currently progressing simulations using realistic operational scenario and optimisation (e.g. fine tuning of VDL 2 parameters, separate en-route and terminal frequencies ...)	Noted, general comments added on this and further discussion at workshop.
184	Eurocontrol	8	Executive Summary	Annex C2 VDL2	"VDL2/ATN is likely to be the first real continental ATC datalink, but will require several frequencies. Suppress "likely to be": VDL 2 /ATN is currently deployed by SITA and several airlines have ordered airborne configuration Several frequencies is not specific of VDL Mode 2. I propose to redraft the sentence as such: VDL2/ATN is the first continental ATC datalink.	Agreed

185	Eurocontrol	2	Executive Summary	Annex C2: VDL3	The introduction of VDL3 in Europe for voice is unlikely because of the spectrum congestion. For Europe having gone to 8.33 the migration back to 25kHz is unlikely because (among other reasons) of lack of free frequencies to enable the migration and the need of coexistence for some time of the two systems (no big bang possible) The consideration of VDL 3 as a datalink only, although technically possible, would raise questions in terms of eventual benefits.	Noted
186	Eurocontrol	1	Executive Summary	Annex C2: VDL4	The ST15 study had calculated around 9K for 16 octet messages. This size provides a constant waste of 5 octets (1 VDL mode 4 slot is 21 octets). Therefore a "quick" correction to fully utilise the slot would be $9 \times 21 / 16 = 11.8K$ . If multiple slots are used (concatenated) then the useful rate will increase if access is by reservation. However 14k (considered to be a little bit optimistic), is not far from a value of 12.	Noted
187	Eurocontrol	2	Executive Summary	"Assessment of data link technologies supporting broadcast services" Table	VDL M4: "Airborne VHF interference issues are still being addressed by Airbus through the NUP programme. VDL2 may be adversely affected by the operation of VDL4 on the same airframe": Interference issues are not only progressed by Airbus. At least the DFS and Eurocontrol are contributing To be exhaustive, interference from the VHF (analogue, VDL M2, ACARS) systems to VDL Mode 4 shall also be mentioned Availability of the required number of at least 2 additional channels (in addition to the 2 being progressed in the COM band) is still an issue (assumed to be in the Nav band – availability, ITU regulation)	Noted
188	Eurocontrol	9	Executive Summary	Annex C3: 1090 ES	In the 1090 ES section, it is mentioned that 1090ES does not include the CDTI for ADS-B In and implies that these will obviously cost extra money. This may lead the reader to imply that VDL4 and UAT do include the ADS-B In CDTI functionality, which of course is incorrect. Either add a general note applicable to all 3 data links regarding ADS-B in additional costs, or add a similar note to each of the other sections.	The other links do not include an ADS-B out only option.
189	Eurocontrol	1	Executive Summary	Annex C3: UAT	UAT has the best performance (TLAT) in terms of capacity/range of the three links, but still did not meet all the requirements (notably number of TCPs and range). This indicates and supports that a dual link is the best/safest approach for ADS-B applications.	Started to add
190	Eurocontrol	2	Executive Summary	Summary of data link roadmap Step 1 - Rational	Suppress "early" The simulations tool for planning VDL M2 frequency deployment is under development and will be available mid 2003	OK
191	Eurocontrol	7	Executive Summary	Summary of Community actions Table	Do you really think that sector rationalisation would be done with the objective of minimising the number of frequencies?	No, sector rationalisation will be done to minimise the number of sectors (and therefore frequencies)
192	GP&C Global Support Ltd. (GGS) (Denmark)	3	Technology Assessment	Lowest box of section J.5.2	Against the entry for 'GP&C Global Support Ltd. (GGS) (Denmark)' write:  GGS are manufacturers of VDL4 airborne and ground stations. for aviation use. One GGS delivered system is certified in Peru. GGS produces data link equipment for maritime use.	Done
193	Astrium	7	Technology Assessment	AMSS	Judgement on AMSS is overall quite positive, as a mature and fully qualified system. Good coverage and best suited for beyond line-of-sight operation. Relatively high cost for avionics and communication charges. AMSS is purely based on the existing Inmarsat system (plus Inmarsat 4).	Noted
194	Astrium	9	Technology Assessment	AMSS	In terms of the cost assumptions: (1) There is a typo on page 109 of the roadmap document. The cost for ground station should read EUR15,000,000 (instead of EUR150,000,000).	Done

195	Astrium	9	Technology Assessment	AMSS	(2) Cost assumptions seem reasonable and are very well referenced. There is just one thing I am not sure about. Inmarsat 4 is going to use 2 spacecraft with one in-orbit spare. The manufacturing cost of 140 MEUR per spacecraft were applied to all three spacecraft. I think that usually with this kind of deal any spare spacecraft are usually free of charge, since they are just a duplicate. Obviously launch cost apply. Based on this the assumption on the infrastructure cost might be too high, but in the end it does not have a great impact on the overall system cost.	Noted
196	Astrium	9	Technology Assessment	AMSS	(3) The Inmarsat system is not only used for ATC applications but also provides services to other commercial and institutional customers. The cost for the system would be accounted respectively. Since most other systems (like VDL etc.) would be almost entirely established to fulfill the specific ATM demand, the comparison between the infrastructure cost is probably not quite fair.	Noted
197	Astrium	4	Technology Assessment	NGSS	The overall perception of NGSS seems rather negative, although the document clearly states that there advantages that must not be ruled out.	The negative assessment should only apply to previous NGSS, study authors have grate expectations of next generation assuming they are designing them with an aviation mission in mind
198	Astrium	9	Technology Assessment	NGSS	(1) I am slightly concerned that NGSS is set almost equivalent to Iridium. This methodology was also applied to the cost calculations. Since Iridium was the first constellation on that scale, the development and hardware cost were extraordinary. With 4.5 bn EUR for the ground cost (incl. the spacecraft), NGSS is by far the most expensive option.	Yes, see previous comment, NGSS should be seen in this context only as previous BigLEO and MEO, new initiatives are not really included, but are encouraged.
199	Astrium	9	Technology Assessment	NGSS	(2) I fully understand that the authors are trying to stick to known initiatives with some real information to base assumptions on. In the light of 'next generation' satellite systems other options should be considered and properly evaluated in terms of cost.	Agreed, but lack of information of credible options make this difficult in this study, recommendations that detailed work on future satcom added.
200	Astrium	9	Technology Assessment	NGSS	(3) However in comparison to the cost for the Galileo development and deployment, the quoted cost assumption might not be too far off for such a constellation, since the political arguments and the workshare split between European countries for an ATM constellation would be probably quite similar.	Noted
201	Astrium	4	Technology Assessment	SDLS	There is not an awful lot in the study about SDLS. It seems merely to be seen as a R&D exercise that does not significantly contribute to an increase of ATC capacity.	Noted. Due to lack of information. More is now available on nexSat
202	Astrium	9	Technology Assessment	SDLS	(1) For SDLS they assume, that two GEO spacecraft would be required and charge them at 140 MEUR each. I think, that SDLS is planned to be only a piggyback payload on two GEOs. So the actual hardware cost would probably be than the assumed 440 MEUR.	Initial deployment is reuse, ut further deployment includes shift of feeder links which would require new spacecraft
203	Astrium	6	Technology Assessment	General 1	I think the various satellite solutions are introduced and discussed in a slightly confusing way. It is not particularly easy to explain what I mean concisely. However I will try.	Noted
204	Astrium	4	Technology Assessment	General 1	When considering satellite communications options one needs to establish if one is constrained to review only existing satellite systems or if one is free to consider completely new systems. NGSS clearly covers Iridium, ICO and Globalstar but I have always assumed that it potentially includes any new entrant looking to establish a business in the mobile communications area. AMSS is currently provided via the Inmarsat system but I understand that it is not limited to Inmarsat (and may be provided as well by the Japanese MTSAT). The systems mentioned so far basically assume the use of the system by aeronautical users together with other non-aero users - and the systems are mainly commercial (for profit) businesses. In such cases the price to the aviation sector is not necessarily related to cost.	I agree, recommendations do include new satellites, this is supported by ICAO.
205	Astrium	7	Technology Assessment	General 1	In the case of SDLS things are less clear. I understand SDLS to be a system concept, currently in the R&D phase and promoted mainly by ESA, and not an actual system. It is a bit more than a communications protocol but not a lot more. It differs from AMSS but could be delivered by Inmarsat.	Done

206	Astrium	7	Technology Assessment	General 1	I think the report would benefit from an introductory paragraph on satellite solutions that provides the logic before jumping into AMSS, SDLS and NGSS which to a great extent seem to be oranges and lemons.	Done
207	Astrium	4	Technology Assessment	General 2	In several places Inmarsat and Inmarsat 4 seem to be used synonymously. In the timeframe under consideration Inmarsat 5 becomes potentially interesting and in principle any ideas generated by the aeronautical community could influence the definition of future Inmarsat services based on future satellite communications capability.	Noted
208	Astrium	7	Technology Assessment	General 3	Satellite availability issues. I have never been very clear on the question of satellite availability and the number of satellites needed. At present satellite communications services for aviation are not really safety critical. If safety critical services grow - especially if the aviation sector becomes economically dependent on satellites for cost effective flight management - then the demands for greater redundancy in space might grow.	Noted
209	Astrium	7	Technology Assessment	Costs	I found it very difficult to follow the cost data presented. It would help if some preliminary discussion is included so as to determine likely costs to the aeronautical users. The approach adopted seems to include the cost of the space segment - even in the case of Inmarsat which is never likely to be solely an aeronautical services organization. This results in what is probably an over estimate of the costs but again cost and price are clearly different in the case of L-band.	Noted
210	Astrium	7	Technology Assessment	Costs	One way of approaching it may be to calculate the cost of a dedicated aeronautical system and then consider the sale of capacity to other sectors which then makes a proportional reduction in the system cost to aviation.	Noted,
211	Astrium	4	Technology Assessment	Costs	The NGSS services could be delivered by dedicated GEOs at a lower cost.	Noted
212	Astrium	7	Technology Assessment	Frequencies	I think it is best to state a systems frequencies as those of the mobile links only (ie aircraft to satellite or satellite to aircraft) - mentioning feeder link or inter-satellite link frequencies tends to confuse things.	Noted
213	Astrium	7	Technology Assessment	Section 5.3.6.5	I agree that they should be discounted but the reason given in this section is not clear. None of the operators is an institution so I do not see how institutional difficulties in the operators is relevant. The principal difficulty is probably gaining the confidence that the service will still be provided 10 or more years in the future and, in some countries, a dislike of these types of service being delivered by private companies (although Inmarsat is now private). There is an institutional issue here but I think it lies with the CAAs rather than the satellite operators.	Financial difficulties
214	Astrium	7	Technology Assessment	Page 63 - Boeing CS	The second bullet point does not seem appropriate in this type of study: if there were very good reasons for including safety services then I would suspect that effort would be expended to try to accommodate them. I think a bigger issue is that the Boeing system is proprietary in nature and this runs against trends set in the ATM field where proprietary systems are not preferred.	Correct
215	Astrium	4	Technology Assessment	Is there sufficient bandwidth in L-band?	The question of whether there is sufficient bandwidth at L-band for the identified applications is not really addressed and is very important. I would have some doubts about the availability of spectrum in this band for a mature aeronautical system.	Noted for further study
216	Astrium	7	Technology Assessment	Table 8.2 p 88	SDLS last bullet - It does not seem any more capable than services that can be offered by Inmarsat when the Inmarsat 4 space segment is operational. Is there enough spectrum? Boeing - don't like the first bullet for reasons given above	Done
217	Astrium	9	Technology Assessment	Section C.4.3.1	EUR150M seems to be a misprint for 15M	Done
218	Astrium	9	Technology Assessment	Costs	Do costs for airborne equipment reflect fuel penalties experienced by airlines due to increased mass and drag?	No
219	Astrium	7	Technology Assessment	Section E.1.2 - GES	Is AMSS restricted to systems with C-band feeder links (as with Inmarsat) ? I don't see why the definition should be so restrictive.	Only by the current AMSS sarps, a new system would not be.
220	Astrium	7	Technology Assessment	Section E.1.2 - GES	It looks as if AMSS makes the assumption that the space segment involves only transparent transponders. If so it might help to mention it.	Done

221	Astrium	7	Technology Assessment	Section E.1.2 - GES	Inmarsat does not offer world wide coverage since it does not cover the poles - an area where there is some air traffic.	Done
222	Astrium	7	Technology Assessment	E.5.2	Honeywell and Thales have developed Inmarsat Swift64 (not produce)	Done
223	Astrium	7	Technology Assessment	E.6	"Monopoly of Inmarsat" - there does not need to be a monopoly but the start up costs for a rival are high and the revenue prospects poor	Done
224	Astrium	7	Technology Assessment	M.1.2	Principal not principle	Done
225	Astrium	7	Technology Assessment	M.1.3	The nominal Iridium constellation .....	Done
226	Astrium	7	Technology Assessment	M.1.7	I don't think the ICO system itself integrates satellite communications with terrestrial: it is just the best marketing approach There is no real integration of systems.	Done
227	Astrium	7	Technology Assessment	M.3.4	I thought Iridium had 6 spares, each in one of the six orbit planes. 7 spares in 6 planes might just lead to confusion between planes and aeroplanes!	Done, I never use plane to mean aircraft.
228	Astrium	7	Technology Assessment	M.3.4	Iridium ISLs are between nearest neighbour satellites only.	Yes, the point is that if the local GES is unavailable you can use a collection of ISL to get to another GES that is available.
229	Astrium	7	Technology Assessment	N.1.1	The system design is being developed by ESA ..... Best to avoid confusion with an actual deployment.	Done
230	Astrium	7	Technology Assessment	N.1.7	I am not sure the general reader would understand what is meant by spot beams. I have often encountered difficulties here when giving general presentations on satellite communications.	Noted
231	LFV	6	General	General	These comments are based on material delivered to the peer review group for review up till the end of 2002, including the applications assessment, technology assessment and data link road map. The comments supplement previous input given to the consortium leader.	Noted
232	LFV	6	General	General	First of all it should be state that the consortium led by Helios has managed to performed an extraordinary operational and technical oversight of the fairly complex situation concerning the use of data link within the field of ATM. The study capture more than well the importance of the role that data link will play during the next 10-15 years in the struggle to increase the capacity and efficiency in European airspace. It also points to the fact that the applications foreseen include major changes to the present operations.	Noted
233	LFV	1	General	General	In the technology assessment part, which again is probably the most comprehensive study ever made, gives an extremely clear indication that no single technology can meet the requirements and that the required performance by the used technologies are crucial if we want to see the applications defined in operation. The assessment also gives a clear view that solutions, involving available technologies, can be defined.	Noted
234	LFV	6	General	General	In the datalink road map part the industrial and economical issues surface very clearly. Here the optimum technical solutions are of less importance in favour of the need to slowly evolve from existing technologies at a pace decided by existing monopolies for data link service provisions and airframe development. The early intention to describe to two parallel paths for introducing advanced data link use in Europe highlighted the unwillingness amongst the community to the technically and operationally preferred solutions.	Noted
235	LFV	6	General	General	The overall most important comment to the end product of the study is that the data link road map and to an even greater extent the executive summary does not reflect the content and outcome of the operational and technical assessment. It basis its technology and implementation conclusions on commercial plans and decisions made in various European organisations without any references to its possibility to meet the requirements. In short it only manifest the existing situation as the preferred one. Swedavia recommends that the outcome of the study(road map and executive summary), in it present status, is not approved for external use or distribution by the EC.	We have made many changes to address this.

236	LFV	1	General	General	<p>Having said that there are several significant items, of which all have been addressed before by Swedavia to support this position.</p> <ul style="list-style-type: none"> <li>• During many years, both in ICAO and other forums, its clear that time critical applications(of which a significant number is described in the study) cannot be using a non predictive system like ACARS or VDL Mode 2. This was one of the original drivers for ICAO to adopt VDL Mode 3 and Mode 4. Blinded by the need to justify the VDL Mode 2 for AOC and other non critical services the real ATM requirements are neglected. Hence, necessary safety and improvements will not be realised. The unwillingness, although the technical assessment is clear, to adopt predictive system concepts like Mode 3 and 4 shows the conclusions are questionable.</li> </ul>	Noted, general changes made
237	LFV	2	General	General	<ul style="list-style-type: none"> <li>• Spectrum is highlighted as a major constraint throughout the summary, even if the technical assessment indicates that the effective throughput for VDL Mode 4(14 kbps) is 4.7 times higher than for VDL Mode 2(3 kbs) the latter is recommended. Adding the inherent characteristics of the two technologies both re-use of channels and the ability to plan the ground infrastructure this figure will increase significantly. This situation also shows the skewed conclusions when it comes to point to point applications. The list of actions in the summary actually highlights this.</li> </ul>	Noted, general changes made
238	LFV	3	General	General	<ul style="list-style-type: none"> <li>• The present situation with two main datalink service providers, having de facto monopoly on a-g datalink communications, using VDL Mode 2 as their next generation of data link might risk that the liberalisation of telecommunications promoted by EC can be hampered. The conclusions will cement the present situation and a significant risk of killing other, more efficient alternatives, exists.</li> </ul>	Noted
239	LFV	2	General	General	<ul style="list-style-type: none"> <li>• The main reason to dismiss the early introduction of VDL Mode 4 seems to be the co-existence with VDL Mode 2 on AIRBUS and other similar aircraft. Since VDL Mode 4 is an alternative to VDL Mode 2 this rationale seems very strange. Also the other parts of the airspace users like commuter, GA, military and others are not taken into account at all.</li> </ul>	Discussion added
240	LFV	3	General	General	<ul style="list-style-type: none"> <li>• On the broadcast side 1090 ES is defined as the most mature technology. Is clear that two way full ADS-B use of 1090 ES is not there today. The amount of work and evaluation done of large commercial aircraft is very limited. Mode S Elementary and Enhanced Surveillance and ADS-B are different things.</li> </ul>	Noted
241	LFV	1	General	General	<ul style="list-style-type: none"> <li>• 1090 ES is proven to be limited on the airport surface due to multipath and other propagations constraint. Again this shows no impact on the recommendations.</li> </ul>	Noted, comment added
242	LFV	3	General	General	<ul style="list-style-type: none"> <li>• The maturity of the ground components for broadcast services are not taken into account. As an example the first two phases of the ADS-B validation in Eurocontrol will be performed over VDL Mode 4. This unbalance in the way maturity is defined cast serious questions on the road map as present today.</li> </ul>	Noted, comment added
243	LFV	3	General	General	<ul style="list-style-type: none"> <li>• The implementation plans for ADS-B in Sweden and Russia is not mentioned at all in the recommendations. Even if this may not correspond to the larger part of Europe it indicates that some states and regions are willing to adopt the evolving concepts and technologies developed. This is extremely important in terms of introducing applications on a wider scale in core Europe.</li> </ul>	Comment added
244	LFV	6	General	General	<p>Summary: Having been part of the extensive information gathering and operational and technical analysis performed as well reviewing the output material, Swedavia cannot accept the way technical facts and real operational requirements have been handled in the conclusion of the this study. The vested interests among the parties involved have distorted the result, ending in a non-efficient recommendation for data links in Europe.</p>	We have made many changes to address this.
245	LFV	6	General	General	<p>Allowing vested interests to block required safety and efficiency improvements in European ATM sector, should be mitigated by higher decision-making bodies.</p>	Noted
246	LFV	6	General	General	<p>A revision, based on operational, technical facts using a balanced approach towards various implementation options or paths are recommended.</p>	We have made many changes to address this.

247	LFV	6	General	General	If the study remains (road map and summary) and is presented to the end customer in the way it is today, Swedavia will withdraw from the consortium since it does not represent an objective assessment of the options available for Europe today.	We have made many changes to address this.
248	IAOPA-EUR	6	General	1	IAOPA-EUR acknowledges on behalf of GA/AW users the systematic evaluation of the reference material, the presentation of the proposals and the submission of its conclusions to public consultation.	Noted
249	IAOPA-EUR	3	General	2	IAOPA-EUR regrets the over-emphasis of air navigation service providers and airline user requirements.	Noted
250	IAOPA-EUR	3	General	3	IAOPA-EUR considers the absence of explicit GA/AW and military user requirements for instrument autonomous flight operations in the analysis and assessments of the roadmap study a serious weakness that should lead to reconsideration. - The European Commission, the European Parliament Eurocontrol and the European Civil Aviation Conference have stated at numerous occasions that the European Airspace is for the use of all airspace users on equal terms. The roadmap and the underlying technology assessment, including the cost aspects, do not include to any reasonable extent consideration of these needs and growth possibilities for GA.	Noted
251	IAOPA-EUR	3	General	4	Both GA/AW users and state aircraft operators support those findings of the roadmap study that point to early implementation of lower cost safety enhancements suitable for global application. With due regard to infrastructure investment costs, maintenance costs and policy decisions taken by the United States Federal Aviation Administration, IAOPA-EUR shares the experts view that available space-based navigation systems and cellular radio techniques based on unambiguous stable standards offer already today a solid base for implementation planning over a 10 years time window and thus avoids nugatory investments into outdated technologies.	Noted
252	IAOPA-EUR	10	General	5	The focus of the roadmap study on ATM applications and their evolution in time must necessarily lead to different solutions than an assessment based on user specific operational and functional requirements. Drafting technical requirements as a function of ATM applications must lead to unnecessary penalties for the airspace users.	Noted
253	IAOPA-EUR	10	General	6	The top down process for identifying ATM applications from: · Progressive delegation of responsibility to pilots via · Operational spacing and ground-controlled airborne separation to airborne self-separation leading to · ATM applications is far away from the reality of most GA/AW operations. GA/AW users need direct ground support for IFR and VFR flight operations. Where such services do not exist or cannot be made available for whatever reason, GA/AW users and airline users operating in unmanaged airspace need unrestricted access to safety-critical information and support of self-separation as practiced daily by thousands of GA/AW and military pilots. Digital air-air and air-ground data links play a decisive role for the implementation of lower cost safety enhancement applications. IAOPA-EUR therefore supports those findings of the roadmap study.	Noted
254	IAOPA-EUR	3	General	7	It is well known that a large proportion of European GA aircraft can for technical reasons not accommodate certain avionics mandated for the next 10 years. Their owners cannot afford the equipage imposed. If carriage of data link becomes mandatory in parts of the European airspace a large part of the GA community will be driven out of such airspace that they have every right to utilise. Therefore GA/AW users would have liked to see in the roadmap study a GA/AW oriented cost / benefit analysis in which the question of avionics investment, installation, certification and maintenance costs are properly exposed in relation to the capacity benefits obtained.	Noted

255	IAOPA-EUR	6	General	8	IAOPA-EUR sees a need for clarification and concentration of numerous ATM applications on user oriented data link services in support of safe flight operations such as: · Pre-flight information supply to airspace users including weather, validated AIS data, and ATC capacity constraints information for effective flight planning. Pilots like pre-departure clearances “ ..... as filed “ · In-flight data transmission in support of collision avoidance and hazard minimization, including medium and short term conflict alert, · ATM support for efficient use of available airspace and control capacity including flight plan activation and changes, · Reduction of cost constraints for users and service providers.	Noted
256	IAOPA-EUR	6	General	9	IAOPA-EUR recognizes the difficulties and uncertainties in the choice of investment and operating costs for the various existing systems, technologies and standards.	Noted
257	IAOPA-EUR	1	General	10	Qualifying Mode S radar elementary surveillance a mature technology with a 30 years experience record could be accepted provided the real risks, costs and limitations are properly taken into consideration. - Such as high capital investment for outdated technology, expensive maintenance, line-of-sight and physical limitations, mechanical deficiencies, fruits, garbling, processing delays, etc. - However, qualifying cellular radio applications like VDL 3 and VDL4 after more than 10 years of GSM experience feedback and more than 400 million tracked cellular radio users worldwide as “emerging technologies” appears to be a great understatement or at least a serious misunderstanding. So far mode S-transponders do not deliver any safety enhancement over ordinary SSR mode A/C transponders.	Noted
258	IAOPA-EUR	3	General	11	IAOPA-EUR holds the view that affordable digital air-air data link applications based on unambiguous public standards could offer immediate safety benefits to suitably equipped aircraft and service providers in managed and unmanaged airspace. Due to available spectrum, stable standards and extensive experience feedback from 10 years of validation trials, VDL 4 appears to be the most promising standard for GA/AW and ATM applications in Europe and Russia. Its advanced implementation should be given precedence over any mandatory carriage of Mode-S ELS or EHS transponders. A further implementation delay in central Europe of 8 years as scheduled in the data link roadmap study is considered a serious penalty for GA/AW users and an obstacle to voluntary global application.	Noted, comment added
259	IAOPA-EUR	3	General	12	With due regard to the cooperative implementation of any future-save ATM infrastructure for the benefit of all air-space users, IAOPA-EUR supports the idea of direct incentives from ANSPs for voluntary equipage for air-air and air-ground data links transceivers.	Noted
260	IAOPA-EUR	3	General	13	IAOPA-EUR fully supports those conclusions of the roadmap study that propose an accelerated European infrastructure harmonisation and coordination of spectrum allocations in which GA/AW and airline operations are allowed to grow on equal footing.	Noted
261	ARINC	3	Datalink Roadmap Summary	Page 2/3 Step 1 through 5 bullets	The dates against these are over optimistic (Step 1 2006 etc) and assume a rapid deployment of ground services and avionics forward / retrofit, both of which are not evident today. Although some applications defined within step 1 are already operational, step 1 will take far longer than shown and therefore push the others out.	
262	ARINC	8	Datalink Roadmap Summary	Page 3 para starting 'As a result of these developments.....'	Regarding the concern raised over VDLM2 ability to support requirements beyond 2010. This statement seems to be based on two key points: 1. Application availability 2. VDLM2 throughput concerns However, some of the fundamental assumptions on which these two key points are based are significantly flawed, and consequently have a huge impact on the finding of this report. These are discussed later in our feedback on the technology assessment paper.	General discussion added that concern is also QoS

263	ARINC	8	Datalink Roadmap Summary	Page 4 & 6 Data Link Roadmap diagram	This depicts ACARS and AOA disappearing from service in 2008, with VDLM2 being rapidly replaced by M3 & M4 in the 2011/2012 time frame. Our comments on this are: 1. The ACARS implementation utilizing MSK modulation and slotted Aloha media access (referred to in industry as Plain Old ACARS (POA)) will slowly decrease in usage with time but it will not disappear by 2008. A section of our existing customer base is expected to continue using POA through 2010 and beyond. 2. The ACARS over AVLC (AOA) implementation utilizing D8PSK modulation and p-persistence CSMA access is shown as rapidly phasing out over a one year timeframe in 2008. In addition to avionics changes, this transition also implies that the ACARS applications for AOC communication are universally phased out over a one year period, resulting in all airline users to completely redesign their ground host systems to utilize an as of yet undefined AOC application. ARINC's experience is that the airlines are very reluctant to make any changes to their ground host, let alone completely redesigning them due to the cost	ICAO Diagram
264	ARINC	2	Datalink Roadmap Summary	Page 5 Para starting 'The study has concluded that the number of VHF channels needed to support the operation of VDL2 during Step 4 is too high'	This conclusion is flawed, as it is based on flawed assumptions. This is addressed in more detail in the comments in the technology assessment paper.	Noted, general discussion added
265	ARINC	10	Datalink Roadmap Summary	Page 10 onwards	D-RVR is mentioned throughout but we have not heard this discussed at any length in the industry.	Footnote added, it is in the wrong place
266	ARINC	3	Datalink Roadmap Summary	Page 16 (C.2) VDL2: 'Significant deployment plans for VDL2/AOA.'	Should read '.....VDL2/AOA & ATN'. All ARINC VDLM2 ground stations are AOA & ATN capable and in use operationally in the US and Europe. The same would apply to any ground station we deploy globally.	Noted, added to Annex F
267	ARINC	1	Datalink Roadmap Summary	'The effective data rate for VDL2 is of order 3000 bps for en-route airspace'	The report referenced refers to data attributed to ARINC. However, this is an invalid reference and is not applicable to this study. Theoretical, simulation and operational experience to date demonstrates effective throughput of greater than 12kbps.	Noted, general discussion added
268	ARINC	3	Datalink Roadmap Summary	'VDL2/ATN is likely to be the first real continental ATC datalink, but will require several frequencies.'	Note:VDLM2/ATN has been operational in Miami since Oct 2002. It uses only one frequency, with no planned provisions for a second frequency. There are also plans for operational VDLM2/ATN in Europe by mid 2003, again on a single frequency.	Noted, added to Annex F
269	ARINC	3	Datalink Roadmap Summary	'VDL2/ATN does not support long term goal of tactical datalinks'	We can't find where this is backed up in the technology assessment apart from just stating it; please provide a reference.	Lack of QoS
270	ARINC	3	Datalink Roadmap Summary	'Retained for use as VDL2/AOA and initial ATC'	Disagree, see above comments.	This means that the roadmap include VDL2/AOA and VDL/ATN. I assume the disagreement is actually that VDL2 can support more, eg step 4?
271	ARINC	3	Datalink Roadmap Summary	Page 16 (C.2) VDL3	Note, the FAA recently stated 'VDL 3 will be for voice and ATS data only, AOC data would remain on VDL2', as stated at ATN2002. Therefore AOC data and possible some ATS data will remain on VDL2 & ACARS, it will not disappear.	Agree, added
272	ARINC	3	Technology Assessment	Page 22 3.3.5.2 First Bullet 'ARINC and SITA deployments of VDL2 for AOC usage'	This is not correct. VDLM2 is capable of supporting AOC and ATS on a shared system.	Added
273	ARINC	3	Technology Assessment	Page 23 3.3.7.3 'VDL2 plans are to support AOC using AOA (AOC over ACARS) rather than ATS (over the ATN) which will come later.'	This is not correct. ATS over ATN has been operational since Oct 2002 in Miami for FAA CPDLC Build 1. In addition, all ARINC ground stations are AOA and ATN capable. Also the use of AOC & ATS applications over VDLM2/ATN is already available.	Agree, added later

274	ARINC	10	Technology Assessment	Page 26 4.2.3 Step1	Does not mention DCL as an early application, yet it is already operational at multiple locations in Europe today. D-RVR is also mentioned as an early application yet we are not aware of anyone looking seriously into this.	Agree, D-RVR is a mistake, DCL should be here, may be a subset of ACL, I need to check
275	ARINC	10	Technology Assessment	Page 32/36	Some of the key figures in this section of the document are in error and we believe this is heavily contributing to the claimed excessive level of required bandwidth required to support the services. For example: Terminal area/Surface movement area: This is a synopsis and not a complete list · The time period does not seem realistic · NOTAM's, SNOTAM's and D-SIGMET will not be requested every flight and most airports will not have SNOTAM service at all · Digital Delivery of expect Taxiway Clearance (DDTC) like application are not mentioned at all. · It is assumed that in step 1 (starting 2004) on every sector an aircraft will request the following twice: CPDLC apps DLIC etc, D-ATIS, METAR & D-RVR, both of which are unrealistic · D-ATIS is only available in a limited number of airports and current 5 year plans do not show the service being wide spread within the next 5 years. · METAR information is requested via the airline AOC application and is not an ATS application, also METAR messages are not as large as stated, finally a D-ATIS	Noted, insufficient time to deal with this in detail. The number sused as consistent with other work.
276	ARINC	1	Technology Assessment	Page 52 to 54 Table 5-3, 5-5 & 5-6	The VDLM2 throughput figures given here are not valid, more on this later see Appendix F comments.	Noted, general discussion added
277	ARINC	9	Technology Assessment	Page 57 Table 5-9	This shows the cost per VDLM2 ground station as 60,000Euros. We cannot comment for SITA on this point but in ARINC's case almost all the POA ground stations in Europe are easily upgradeable to a bi-lingual POA/VDLM2 at a reduced cost. Same applies for installation cost for the same reason; also the maintenance cost for locations which are bi-lingual would be shared between both services. There is no line entry for the cost of running the service/network itself, this is a significant cost. For a true picture you need to factor in the cost of running a 24/7 operational department, technical support and commercial staff etc.  There is no entry on the costing sheet which captures the "hidden" costs of additional funding received by any of the parties. For example, VDL2 has been specified, developed and deployed on private money (ARINC, SITA, avionics vendor and airline money), based on a commercial business case, whereas other technologies have had considerable government funding which creates an uneven playing field and a skewed picture of the actual	Noted ,and comments added
278	ARINC	9	Technology Assessment	Page 58 Table 5-11	This shows the main avionics costs applied to VDLM2 with VDL3 & VDL4 only as retrofit costs - this isn't comparing apples with apples. Also, the upgrade is listed as only 8,000 Euros - this seems very low since the radios at least should be completely new equipage.	Noted ,and comments added
279	ARINC	3	Technology Assessment	Page 59 – 5.2.6.1: 'has been selected for deployment for AOC by ARINC and SITA'	Should read '...AOC & ATS...'. Also the last sentence "VDL2 does not provide efficient use of scarce VHF channels.", should be removed as it is unsubstantiated.	Noted, general discussion added
280	ARINC	1	Technology Assessment	Page 63 VDL2 bullet 'The effective data rate for VDL2 is 2800 bps for en-route airspace.'	Should be removed as it is unsubstantiated.	Noted, general discussion and ARINC diasagreement added
281	ARINC	8	Technology Assessment	Sections 7 & 8 Scenario Selection & Summary	These are based on flawed information as detailed above therefore we are not prepared to comment.	Noted

282	ARINC	3	Technology Assessment	Appendix F VDLM2	<p>Our general comments are that this section of the documents has significant errors and completely misrepresents the status of VDLM2 programs, deployment and aircraft equipage. In particular out dated / discredited study data has been used to draw a conclusion regarding VDLM2 capacity which is completely unacceptable.</p> <p>We have corrected Appendix F as best we can and I have attached it as a separate file (file name F updates.doc).</p> <p>Please review our updated section F. If you wish us to re-review section F once you have updated it, we will be happy to do so.</p>	Noted, comments and discussion added
283	CNS Systems	3	General	General comment	<p>There is support in it for a continuation for a monopoly market on the communication side. Although VDL Mode 4 is existing and has interested customers there is a massive support for VDL Mode 2. It is worth to notice that VDL Mode 2 has not been deployed yet. Yes, there are some test sites working with digital ACARS but in my opinion they are to VDL Mode 2 what the initial trials in NEAN with STDMA was for VDL Mode 4. The existing service providers are supportive for VDL Mode 2 and therefore they state that there is a wide support for VDL Mode 2 in the aviation industry in Europe. Fact is that no airline on a commercial basis so far has invested in anything for VDL Mode 2. SITAS and ARINC's strategy seems to be to try to maintain their monopoly situation in the AOC market. I do not think that the EC is in favour of a monopoly situation.</p>	Noted,
284	CNS Systems	3	General	General comment	<p>On the surveillance side is it wrong to say that 1090 FOR ADS-B is a mature technology. Yes for standard ATC applications, but no trials has been done with a non negative result with any ADS-B like transmission on 1090. Fact is that 1090 in real world still is at a level were very few trials have been performed. There is of course a large pressure from the radar industry to say that 1090 is fine for ADS-B, but do the comparison with the mobile phone market. Today's GSM phones are very good for normal talking, but when the data rate needs to be higher they can not do the job. Using them to surf the internet is a very slow and often unsuccessful task.</p>	Lack of large scale trials for 1090 has now been added
285	CNS Systems	1	General	General comment	<p>So far VDL Mode 4 is the only technology proven to work on the ground. This has not been reflected in the summary. Runway incursions is one of the worst threats to air safety today. (maybe terrorism excluded).</p>	Noted
286	CNS Systems	3	General	General comment	<p>For ADS-B ground use Com 4 Solutions has a great demand from our potential customers for AOC purposes. This market is totally neglected in the summary. The reason I suspect is that that is an application that is not supported by the old systems. Therefore the people working with old technologies does not realise that it exists. Nothing strange with this, but nevertheless important.</p>	AOC in not in the scope of the study, Com 4 plans have been added.
287	CNS Systems	3	Technology Assessment	Annex J	<p>I have checked the prices for Mode 4 ground stations. For point-to-point only: 100 kEur, For ADS-B: 120 kEur, For a combined: 150 kEur, Installation cost per ground station is 2-3 kEur</p>	Done
288	CNS Systems	3	Technology Assessment	Annex J	<p>Also the price of the avionics for VDL Mode 4 seems too high. What we offer as a development program for NUP 2 to Airbus is 10 units for a price of 50 kEUR / unit. For a serial production we offer considerably lower prices (30 - 45 kEur depending on number of units ordered)</p>	Done
289	Sofreavia	6	Datalink Roadmap	3.3.2	<p>Why has ADS-C not been mentioned in the list?</p>	Added (previous version)
290	Sofreavia	6	Datalink Roadmap	4.1.4.1	<p>Mode-S Data Link could be added in the list and has not been included at all in the scope of the study. Whatever decision is taken about Mode-S DL, it cannot be totally forgotten by the study.</p>	It was agreed at start of study not to include Mode S SVCs. Note added to this effect

291	Sofreavia	6	Datalink Roadmap	4.1.3. Table 4-1	Same comment as comment #2. In addition, this table appears to be restrictive or some assumptions are missing to fully explain the rationale of how it has been filled in. For instance, AMSS like the other satellite technologies could provide Air to Air datalink and broadcast although passing through terrestrial infrastructure. AMSS Uplink broadcast is also supported. The 1090 ES and UAT technologies could allow the Air to ground and air to air datalink facilities. In other words, are merits of technologies judged only upon their current characteristics with the hypothesis that they cannot evolve?	See previous
292	Sofreavia	1	Datalink Roadmap	4.2 Table 4.2 VDL2	VDL2 throughput is about ten times more than 3000 bps: 31,5Kbps. The statement that "VDL2/ATN does not support long term goal of tactical datalinks" should be explained or reference should be made to a "remote" explanation. What are the system limitations that led to such a conclusion?	Explanation added
293	Sofreavia	6	Datalink Roadmap	4.2 Table 4.2 VDL4	The statement "...longer broadcast history" should be explained. Second bullet "VDL4 is capable of providing more ..." should be justified. Third bullet: Why would regional or general aviation invest in VDL4 for AOC rather than in VDL2?	Explanation added
294	Sofreavia	4	Datalink Roadmap	4.2 Table 4.2 SDLS	Fourth bullet: SDLS was designed to overcome INMARSAT limitations. The statement is therefore surprising and should be explained if we want to avoid a strong reaction from ESA.	Modified
295	Sofreavia	6	Datalink Roadmap	4.3 Table 4.3: 1090	Sixth bullet: "will not support any air to air application" why?: TCAS is based on the use of 1090 in an air-air communication (TCAS coordination).	Note added
296	Sofreavia	1	Datalink Roadmap	4.3 Table 4.3: VDL4	Second bullet: "provide other services such as ATN communications...": this remains to be proven. "it is the only link with a good air to air datalink": The term "good" is not precise, good from which point of view? Fourth bullet: VDL4 may be adversely affected by operation of VDL2" The sentence must be reversed, i.e. VDL2 may be adversely affected by operation of VDL4. The reality is that VDL2 has begun to be deployed. Service is offered by ASP. Considerable investments have been performed by industry. VDL4 is a potential candidate technology for new other services and future replacement of VDL2 in some areas. However, if VDL4 is envisaged to be deployed in the future, it would have to take into account an existing VDL2 infrastructure and would have to provide solutions not to adversely affect VDL2. Although the interference of VDL4 to VDL2 is symmetric, the sentence as stated in the document, appears to be oriented. Seventh bullet: "... VDL4 could be in widespread use by 2006": the statement is not appropriate in this document as not relying on	Notes added
297	Sofreavia	1	Datalink Roadmap	4.3 Table 4.3: UAT	Second bullet: "UAT does not support point to point applications" what does it mean?	UAT is broadcast only
298	Sofreavia	2	Datalink Roadmap	4.3 Table 4.3	General to this table. The frequency availability issue is carried out differently depending on the technology. This issue is presented as a problem for UAT ("there is a serious concern about European availability of a suitable frequency for UAT ...") which appears to be negative for the deployment of that technology. But the same issue for VDL4 is presented as a series of actions as " VDL4 will require a concerted effort to free sufficient bandwidth. Work on channel management plan, ..., is critical and urgently required.". This lets the impression that VDL4 is favoured.	The serious concern is the use of a DME frequency in Europe which is problematic. VDL4 would use VOR frequencies of VHF spectrum, which although difficult is still easier to envisage. Note that VORs are planned to be decommissioned whilst Europe requires an extra 180-200 DMES to support RNP RNAV.
299	Sofreavia	6	Datalink Roadmap	4.4.2 Table 4.4	The rationale of selecting candidate technologies for the various steps must be explained or reference must be made to other document/section. Satellite technologies are not proposed to be candidate technologies: although in the short term the price remains the main problem in the use of the satellite technologies, it appears difficult not to consider these technologies in the medium and long term. Why is 3G considered the only technology viable for step 5b ?	Notes added

300	Sofreavia	6	Datalink Roadmap	4.4.1.1 Table 4.5	The rationale to define these scenarios must be explained. In particular, scenarios involving more than 3 technologies will be difficult to implement. In addition, timing of the applicative steps should be used to structure the scenarios. According to the schedule provided in figure 3.1, there are three periods that could be considered; step1 (up to 2006), steps 2+3+4 (from 06 to 2010) and steps 5a+5b (10 to 20). Some explanations should be added on how to read table 4-5, stressing the fact that once a technology is deployed in a previous step it is considered as deployed once in a next step. Otherwise, the mapping of table 4-4 onto table 4-5 can seem very unclear to readers. For example, the reader could misunderstand while considering in step 4 in table 4-4, VDL2 is identified as a proper candidate, but never appear as such in table 4-5 for step 4. Same remark for meaning of "None" in step 4. A general comment is that, in the present document, the reasons for choosing these scenarios do not appear clearly enough, leaving the impression that not	Notes added
301	Sofreavia	6	Datalink Roadmap	4.4.1.3	Only 6 criteria to assess scenarios seems weak. The criteria need to be explained: For the cost criteria which kind of cost has been considered? In particular, is there royalty fees or patents on some technologies that would affect the cost? What does interoperability mean exactly? Additional criteria that seems important could be: The preservation of the investment already made which is essential for the step1 technology choice. Complexity: could be a criteria on the mixing the number of technologies involved in the implementation of the scenario, the existence and number of technological jumps, transition issues. In this section, as well as in section 6, it seems that only investment costs have been considered, and that operation costs have not been considered. Is this true ?	The analysis is only intended as indicative (otherwise we would be forced to chose the highest score). See P167D2020 for fuller explanation.
302	Easy Jet	6	General	General	HOLISTIC: The subject being reported intimately interconnects with significant parts of aircraft operation. According to segment the discussion to 'ATM' at the expense of the other key connected activities results in a narrow view of the world.	Noted
303	Easy Jet	8	General	General	Collaborative Decision Making: One of the significant concepts we are embarking on is collaborative decision making. By implication, this is only seriously possible if all actors are connected by the same or similar system i.e. to have continuing confidence that there are 'no' limitations built in that only really show up when the system is most needed i.e. extreme load when 'a lot' of decisions are required to to transacted e.g. during a severely disrupted operational day (refer to input by LfV/J Nilsson on this issue – real concerns here)	Agreed, CDM was not fully considered as the basic air-ground information is covered by other ATS applications and this study did not consider AOC or communications at the gate (due to lack of standardisation applications in this area). Notes added to highlight this weakness.
304	Easy Jet	6	General	General	Airline Operational Control: Helios are to be congratulated for taking the initiative of producing, on their own initiative a report on 'Non-ATS Applications' (P167D1050-V0.01-20020525). The need is phrase in the positive e.g. AOC Applications' and expanded to provide balance. Also weighting for AOC must equal/be high ATN or 'new' operators particularly will have no reason to equip i.e. (unless mandated); Terms of Reference MUST include AOC in Application Roadmap i.e. Criteria 'support for non-ATS apps should be removed' entirely. NOTE: AOC does not include passenger entertainment/IFE but may include rear cabin activity of small volume i.e. narrowband apps but not broadband such as video.	NOT IN SCOPE; But it is clear that the importance of AOC should be highlighted.
305	Easy Jet	6	General	General	CLARITY: The EU requires a paper report such as this to be produced. This should be basic but not limiting. It is the 21 <sup>st</sup> century; why are we persisting to exclusively use 16 <sup>th</sup> century methods i.e. writing on paper only? There are numerous methods freely available to clearly link and show transparently, the interrelationships between the items under discussion. Even a spreadsheet, well used, could add significant clarity. Use of a database should not be ruled out. Diagrams can be contained in a presentation system e.g. powerpoint. Overall the paper will provide 'backup' should any of the more advanced applications not be available.	Noted

306	Easy Jet	6	General	General	INFORMATION: The overall subject has an enormous volume of work behind it. The overall difficulty is, that unless one is immersed in to full time, it is close to impossible to get one's head around it. It is important to agree some long-lived method of consolidating the parts of the information that serves to drive the future world and allow ready access to every document produced with public funds as a minimum. Use of the EU database to find some of the 260+ referenced documents is impossible; it doesn't work.	Noted (The Project Website is provided as a service by Helios and is not part of the EC).
307	Easy Jet	6	General	General	ACRONYMS: Acronyms are a virus that prevents understanding. Aviation is rife with them, many having numerous meanings. A real impediment to understanding. Where possible they should NOT BE USED. Word processors don't care about a few extra words. Use of more advanced means such as spreadsheets would significantly cut down the overall number of words anyway.	Noted (Insufficient time to implement)
308	Easy Jet	6	General	General	GLOSSARY: Essential. There is a continuing assumption that all readers clearly understand the terms used. Again use of the helpful elements of modern technology are needed e.g hyperlinks. See end of this document for terms noted as needing adding or definition	Noted - consider adding if time permits
309	Easy Jet	6	General	General	INDEX: It is not difficult to generate an index and accordingly it should be a mandatory feature of such reports. Finding all the discussion on a particular item is near impossible with only a table of contents to help.	Noted - consider adding if time permits
310	Easy Jet	6	General	General	CONNECTION: For a report such as this, all parts need to electronically connected, they must not be treated as isolated documents; see index, glossary, acronyms etc.	Noted
311	Easy Jet	6	General	General	The Low Cost Reality. The future looks more low cost airlines. Accordingly, all participants in this roadmap must accept that it is axiomatic that way to deliver low cost outputs is to focus on low cost inputs. Therefore solutions that are technologically advanced i.e. won't be obsolete in a short time, are, or tend towards being 'universal enablers' and are available in the short to medium term, is what is required. All airlines are now showing signs of following the low cost model to some extent.....	Noted
312	Easy Jet	10	Datalink Roadmap	General	SAFETY: Overload. This condition is acknowledged to exist both openly and by those closely associated with daily delivery. New installations may not really help in the long term, as they take years from concept to realisation and the world changes in that time.	Noted
313	Easy Jet	10	Datalink Roadmap	General	SAFETY: Skill. The existing Aeronautical Control Centres either cannot cope due to inadequate availability of trained personnel. Alternatively they fail due to the weakness of the human in such a complex system e.g. Lake Constance accident and Milan Linate	Noted
314	Easy Jet	10	Datalink Roadmap	General	SAFETY: Growth. Europe's economic engine is doing what is intended; growing. Transport is a major facilitator of that; air travel is a cornerstone	Noted
315	Easy Jet	10	Datalink Roadmap	General	SAFETY: Monitoring Mechanism. Use Eurocontrol Safety Regulation Committee Report DOC2 Version 3 Dec 2002 as template but reverse emphasis from accidents and fatalities to INCIDENTS. These are active indicators of trend and predictor of potential points of failure on a daily basis. Create as web-enabled central database. All national regulatory authorities can use this to record local events etc etc	Possible action?
316	Easy Jet	10	Datalink Roadmap	General	CAPACITY: ATM. There is a very important consideration with respect to VDL4 at least (other media may also qualify). This is the possibility of using the aircraft as message routers i.e. a message originating in the south of Europe could travel to the North without touching the ground until the intended addressee i.e. a ground-based one, was reached. This would seem to 'unload' the 'normal' message path and as such could be significant in AOC communications at least and add to overall system capacity. Has this been recognised or evaluated anywhere?	No, it is a known idea, but the necessary r&d to fully prove it has not been performed.

317	Easy Jet	6	Datalink Roadmap	General	CAPACITY: VHF Spectrum. Aeronautical radio spectrum is a freebie - <u>aviation wastes spectrum</u> . No cost therefore not valued; compare with 3G spectrum cost. Do we have to be forced to pay to conserve? or "are we intelligent enough to maximise our advantage?" conserve by use of most efficient technology. 2003 ITU conference will focus on this; global, regional, local frequencies; we MUST uplift technology that uses spectrum efficiently e.g VDL4. Need assessment as to the real value of aeronautical spectrum and this should be included in the cost assessments of each link type	Noted, a footnote has been added indicating latest thinking in UK on licence fees being based on spectral efficiency
318	Easy Jet	6	Datalink Roadmap	6.3.2 Fig 6.2	suggest % capacity be replaced by message volume parameter i.e even '120% capacity may not be enough....	??
319	Easy Jet	19	Application Assessment	App2b	Traffic Volume. What is annual number of movements and growth, both historic and projected, that (a) start and end within ECAC; (b) start and end outside the ECAC (i.e. focus on oceanic mainly) i.e how significant is CPDLC a productivity tool for oceanic clearance v other ECAC users... the oceanic case offers 'nothing' for 'ECAC only' users...ARINC 623 seems to focus on oceanic too; the remainder i.e D-ATIS is useful but is nowhere near a compelling reason to uplift say VDL2 or VDL4	Noted
320	Easy Jet	9	Application Assessment	3.3.6;	where is true cost of Mode S shown?	
321	Easy Jet	10	Application Assessment	Fig 3.1;	where is 'full Collaborative Decision Making'	
322	Easy Jet	3	Application Assessment	Fig 4.1;	Universal Enabler - Very significant characteristics summary; obvious point of note is only 2 technologies can deliver to all Groups i.e. VDL4 and 3G/UMTS. However, assuming announced roll-out of VDL4 network (COM 4 Solutions by end 2004), then ADS-B moves into 'significant decisions'...NOTE: VDL2 network is only starting implementation	
323	Easy Jet	6	Application Assessment	Fig 4.2	errata; SDLS - 3rd para, 'that' should be 'than'	
324	Easy Jet	3	Application Assessment		4 1090ES. 4th paragraph is very significant (as are previous 3 on interoperability conflicts). Reason to seriously doubt the safety technology cost etc etc of method- in use by 2006... see 1.5.2	
325	Easy Jet	2	Application Assessment		4 VDL4. Also in use by ?2004?	
326	Easy Jet	8	Application Assessment		4 Ref 4.4 These scenarios make more sense if 'real available dates' of each technology (earliest and latest best estimates). However even this is not enough to make it believable. What makes it believable is when the actors will be equipped and how do they become equipped? i.e. we can't have a 'half-pregnant' ATM environment indefinitely...	
327	Easy Jet	6	Application Assessment	5.2.3.5	Aircraft Movements; 1999 figures out by factor of 10?	
328	Easy Jet	6	Application Assessment	5.2.3.11	Data Collection - European system/database of INCIDENTS ESSENTIAL.	
329	Easy Jet	6	Application Assessment	5.2.4.3	airports at which there are the greatest constraints - (in total AFTM minutes of delay) - of the 18 'worst', Easy Jet operates to 12 (number below is rank); we are evaluating these at present [1 Frankfurt 2 Athens 3 Amsterdam 5 Paris CDG 6 Zurich 8 Barcelona 9 Madrid 13 London Gatwick 14 Munich 15 Paris Orly 17 Hamburg 18 Nice]	
330	Easy Jet	6	Application Assessment	5.2.4.8	'system at or near capacity'; and we are talking about doing things in years ahead to mitigate.	
331	Easy Jet	6	Application Assessment	5.2.4.10	'prevents new flights being introduced...' i.e. is totally counter EU transport policy...	
332	Easy Jet	9	Application Assessment	5.2.6	Cost Effectiveness - ATS is a monopoly; as such it is wrong that there is no active Service Level Agreement, where charges are based on service delivery. Airlines should get credit when they are constrained due to ANSP. Competition sharpens the focus.	
333	Easy Jet	8	Application Assessment	5.4.9.4	71% - This is where we need to move to asap.	
334	Easy Jet	8	Application Assessment	5.4.9.5	200% NOW WE ARE TALKING..	
335	Easy Jet	10	Application Assessment	5.4.11.8	R-NAV - It is close to scandalous that RNAV is not fully operational. Airframers and airlines have done their bit, carried the cost and are now wasting capital investment daily. URGENT...	
336	Easy Jet	8	Application Assessment	5.4.13.1	Safety - VERY IMPORTANT SECTION, 'significant' - YES. One of the two reasons for the Datalink Roadmap	
337	Easy Jet	10	Application Assessment		5.5 Summary - Real important; we have to get the pilot actively in the loop if we are to cope.	

338	Easy Jet	8	Application Assessment	6.2.2.5	GC/ADS-B-ADD. Ref para 2...The last sentence is correct and CRITICAL. "The Community needs to decide if it is better to extend to Mode S mandate to cover enhanced surveillance applications or whether it is better to invest in widespread adoption of ADS-B technology."- this is critical because operators need to make capital investment decision; need assessment of options/costs	
339	Easy Jet	2	Technology Assessment	General	FREQUENCY LEVEL PLAYING FIELD. There is a repeating flavour running through the report, saying in effect 'because there are limited VHF channels, VDLm4 is penalised' i.e. it is negative tends to imply that V4 is a 'guilty party'. What must be done is to assess it on a level field basis; looking at the VHF aero spectrum available for all uses; is it adequate and how should it be used to ensure the most efficient type gets the space it needs?	Noted, general work done to address this
340	Easy Jet	1	Technology Assessment	General	ATM PRIORITY. How can VDL2, with no prioritisation (F.3.2.Priority Management) be proposed as part of an end to end system over one that supports all 15 ATN levels (J.3.2.Priority Management)? So, ref 3.3.1, The criteria 'Support for AOC Communications' [Note positive phrasing.] Scores 4 & 5 should be removed and included in criteria 'Frequency Availability'.	General comments added.
341	Easy Jet	6	Technology Assessment	General	CRITICAL MASS. It is probably 'low cost' for the EU to 'give' equipment etc to users. i.e. achieve a 'big bang' and let us all get on with 'the business' rather than put EU energy into indefinite enabling research & development advancement. The fact that one supplier is offering a digital radio that goes in the existing ACARS radio slot, that will operate as either a VDL-ACARS, VDL2 or VDL4 radio means that an operator so equipped could continue operating as they do now and when all is ready, all swap to VDL4. Remember we did this for 8.33 and RVSM with no significant difficulty. NOTE: Indications are that modern digital radios will provide all the above for an equivalent or possibly (volume driven for sure) lower unit cost....NOTE: A low cost digital VHF radio is being created for general aviation; 8.33khz & VDLm4...	Noted
342	Easy Jet	6	Technology Assessment	General	POSSIBLES & PROBABLES. While it is important that all possibilities are examined, the probable solutions for Europe need to be separated from the possibilities at an early stage to allow a much stronger focus on operationally deliverable solutions e.g UAT, VDL3 and satellite possibilities need to be put in 'background...	Noted
343	Easy Jet	6	Technology Assessment	1.1.5 Stakeholders	Did not include low cost airlines; only industry growth occurring here i.e will drive significantly ATM2000+ growth	Noted
344	Easy Jet	1	Technology Assessment	2.3.1 & 2.3.6 Mode S	Refer to DADI-2 Report. ADS-B shown to be a more effective mechanism for Downlinked Aircraft Parameters than mode S. Therefore mandate should allow ADS-B ex VDL4 as a mechanism to achieve DAP's.	DADI-2 report is not a reliable source on Mode S performance, numerous other trials have previously demonstrated Mode S working.
345	Easy Jet	3	Technology Assessment	2.3.3 Deployment	Replace 'programmes' with 'plans'.... one of existing providers has only installed a few of around 150 needed ground stations to date....Recommend accordingly that VDL4 be moved into this section; after all 10 years of R&D, trials and 200m euro is 'significant'	Notes on decisions for all technologies added
346	Easy Jet	3	Technology Assessment	2.6.1 VDLm4 is Universal Enabler Technology	Move VDLm4 from emerging to significant. This table says it all; the only technology that gives delivers functionality and produces a good ROI; add point to point to ICAO VDL4 SARP (2003) and case is even stronger	Noted
347	Easy Jet	6	Technology Assessment	3.2.2.2 Quality of Service Definition/Specification	Where is this?	Noted, more added to 5 and 6
348	Easy Jet	6	Technology Assessment	3.2.2.3 (3.2.2.in error) Table3-1 Enhance Aircraft Operations	Ref Stage 'Standards Development'; is 'validated draft' a correct phrase?	Yes, for example VDL4 DLS is a validated draft, the next step is to be published (which requires a State Letter from ICAO)
349	Easy Jet	6	Technology Assessment	3.2.5.3 Cost effect on report	'order of magnitude' costs only... this is not what has happened to costs in the report. They have become major deciders in the scoring. As such their accuracy needs to be certified or weighting reduced from 4.	ROM costs are normal when such a large range of options are considered, especially when you consider the size of the contract.

350	Easy Jet	8	Technology Assessment	3.3.1.1 Criteria	Basic Question. Is the Application Assessment/map really the best to deliver Safety & Capacity? Safety is not dealt with to anywhere the extent of capacity. Reference Capacity; an assessment of the ideal application sequence to deliver capacity should be made to test the best case...	
351	Easy Jet	8	Technology Assessment	3.3.1.1 Criteria	Priorities. AOC datalink gives an operator immediate benefits (if they don't already have one); the ATM benefits don't appear to the operator until 'later' i.e. 'non ATS...'	Dealt with in 3.3.7
352	Easy Jet	2	Technology Assessment	3.3.4 Frequency availability	Refer 'General – Capacity – Spectrum' preceding... VDL4 is most efficient user of spectrum at 14000 bits/s EFFECTIVE data rate – enroute (ACARS 300 bits/s, VDL2 1200 bits/s, VDL3 5040 bits/s - ex this Report set)	Yes, the number of channels needed should also be a criteria.
353	Easy Jet	6	Technology Assessment	3.3.5.2	Link2000+ typo	Added
354	Easy Jet	1	Technology Assessment	3.3.6.3 Voice	change to SARP's would allow VDL4 voice...	Yes, but I think such a change is too large to consider at this stage. It may be possible to define a new VDL that supports all requirements and is backwards compatible with VDL4
355	Easy Jet	10	Technology Assessment	3.3.7.1 Passenger	This needs to be split into APC and IFE i.e narrowband & broadband	Added
356	Easy Jet	4	Technology Assessment	3.3.7.4 AOC support	This is a more like a requirement rather than a recommendation i.e. an operator should only want to install the most efficient datalink not 2 types....	Agreed
357	Easy Jet	6	Technology Assessment	3.3.8.1 Table 3-4 Senario	Weightings. How were these weightings decided? With reference to perceived importance, AOC use should be weighted as 3, support for voice should be weighted as 3	Agreed, but used 2 for both (Notes that weightings are only designed to act as a guide)
358	Easy Jet	6	Technology Assessment	4 OVERALL REQUIREMENTS	1 Need to add Airports & AOC	Noted
359	Easy Jet	6	Technology Assessment	4 OVERALL REQUIREMENTS	2 Need to use spreadsheet as minimum to aid clarity	Noted
360	Easy Jet	6	Technology Assessment	4.2.3 Step 4 D-FIS-0	Use IEEE 802.11 on ground	Noted - added as comment on Gatelink
361	Easy Jet	6	Technology Assessment	4.3.1.3 Segments	Need 5 <sup>th</sup> segment; datalink. This allows discussion on priority management particularly i.e ATS segment is not likely to be controlled by Ground Network Provider; same for Airborne Segment so 'joiner' is Datalink Segment	Noted
362	Easy Jet	6	Technology Assessment	Table 4-5 Transit delay	These are 'slow times'; appears in part they are as delivered by current ACARS providers; what is REQUIRED delay, not 'possible today' delay. This is QoS stuff.	Noted
363	Easy Jet	6	Technology Assessment	Table 4-5 Priority	Priority management should be requirement for Airborne segment; it doesn't make sense to have it in all others and not here. Imagine if a long (relatively) AOC message eg flight plan or similar prevented a safety critical CPDLC message from being delivered...	Noted
364	Easy Jet	6	Technology Assessment	Table 4-5 Availability	very high'; what does this mean? Quantify.	Detailed in Assessment Framework
365	Easy Jet	6	Technology Assessment	Table 4-5 Integrity	How is airborne integrity 'very high'; what is definition of segment size; needs qualifying	Detailed in Assessment Framework
366	Easy Jet	6	Technology Assessment	Table 4-5 Throughput	How is 'no constraint' arrived at? This line is critical i.e. we know throughput of datalink segment options but not all the others; i.e agree further study; CRITICAL	Noted
367	Easy Jet	10	Technology Assessment	4.4.1.1 Message types & size	Weather, flight plan are not big e.g easyJet text flight plans are inside 2k with weather. Trajectory, not sure.	Noted
368	Easy Jet	6	Technology Assessment	4.4.2 Evaluation Senarios (numbering is repeated here)	Need to ensure tables and text keep together for ease of reading. in fact all tables should be replaced by spreadsheet; allows sorting and accumulation of qualities and 'what ifs' with all senarios; CRITICAL Need to standardise terminology e.g. replace 'surface' with 'airport surface as per 4.4.2.1. Need to add AOC to tables. Recommend diagram be added to show flight profile and message timing; Lufthansa has a good one.	Done, except AOC not added (as not in scope)
369	Easy Jet	6	Technology Assessment	4.5 Broadcast Architecture – Table 4-22	Let's be clear here; safety and capacity are only properly served by Tx/Rx; less than this is sub-optimal as per 4.5.2. What is 'main analysis'?	Agreed; main analysis is the rest of the discussion,
370	Easy Jet	6	Technology Assessment	4.5.3.3 TIS-B	Need to enlarge on 'TIS-B not considered due to latency requirements'	Added
371	Easy Jet	6	Technology Assessment	4.6.1 Data Requirements	Recommend a table/spreadsheet of data examples & size here	Unfortunately, this becomes quite difficult due to the various ways the message set can be formed.
372	Easy Jet	6	Technology Assessment	4.6.2 Evaluation scenarios	Should be in spreadsheet with earlier tables. Spreadsheet can contain Appendix H /reference [15] values too.	Noted

373	Easy Jet	6	Technology Assessment	4.6.2 Evaluation scenarios	Sensitivity of Scenarios - This needs to be explored in conjunction with latency i.e simulation required (if not already done...) to test QoS Specification	Noted
374	Easy Jet	6	Technology Assessment	4.6.2 Evaluation scenarios	Range - Where are the range values obtained from? SARP's? If so, which?	ADS-B MASPS, added
375	Easy Jet	6	Technology Assessment	4.6.2 Evaluation scenarios	Acquisition - Where are the times obtained from? Important for latency values...	ADS-B MASPS, added
376	Easy Jet	6	Technology Assessment	4.6.3 -	should be 4.6.2 etc i.e scenarios are subsets of 4.6.2	Yes, done
377	Easy Jet	1	Technology Assessment	5.2.1.2 Key performance characteristics	Time Delay - VDL4; 1 sec in italics; is this because of earlier comment about point to point needing more work?	Yes, added
378	Easy Jet	6	Technology Assessment	5.2.1.2 Key performance characteristics	Integrity - Where do values come from?	ODIAC
379	Easy Jet	6	Technology Assessment	5.2.1.2 Key performance characteristics	Channel Rate - This line must be split to show Effective Data rate too; channel rate is meaningless other than a datum to show overall efficiency of link type i.e theoretical versus actual	See later discussion
380	Easy Jet	6	Technology Assessment	5.2.1.3 Cope...	Does this mean that an integrity of 10 to the minus 4 is standard ie 5 and six are 'overkill'?	ODIAC/CAO require different integrity levels for different applications
381	Easy Jet	6	Technology Assessment	5.2.1.6 Transit delay requirements	typo; 99.996%.... not 969....Where is the technical specification of these? e.g CPLDC-0 at 10 seconds; this is a long time when one considers how far an aircraft in cruise travels in that time. Again; all this needs to be connected with other segments to see overall sense of this very important part. This section seems a bit skewed i.e there is an earlier 'acceptance' of the 7.5 second transit delay of the other segments and then a recommendation to carry out simulations for the datalink segment. The end to end link needs to be dealt with holistically.	Added,
382	Easy Jet	6	Technology Assessment	5.2.1.8 Transit time	This para is a bit general, please expand. Throughput; needs numbering?	More added
383	Easy Jet	6	Technology Assessment	5.2.1.8 Effective Data Rate	What is a hidden terminal?. URGENT ACTION. Bring to front of report and Datalink Roadmap Report to give visibility i.e these are the potential showstoppers in who subject....	A hidden terminal is one which is not in line of sight of the point of interest. The problem is that you can not tell when a hidden terminal is broadcasting, and so may well inadvertently do so at the same time. An aircraft that can see both may then receive neither.
384	Easy Jet	6	Technology Assessment	5.2.1.9 Simulations	URGENT ACTION. Bring to front of report and Datalink Roadmap Report to give visibility i.e these are the potential showstoppers in who subject.... see comment in 5.2.1.6 too	Noted
385	Easy Jet	6	Technology Assessment	5.2.1.13 Channel requirements	This is arguably one of the most telling pieces of information in the report. The difference in requirement is so extreme that VDL2 and 3 should be 'rejected' here. It is important to bring the proposed spectrum allocation table from Appendix F.1.22 to this part of the report to give clarity (it has no exclusive relationship with VDL2) NOTE: Indications are that VDL4 properly implemented will do not need guard bands between adjacent VDL4 channels. Also it is unlikely to be needed by them for adjacent voice channels i.e non-VDL4, however the VDL mode of an adjacent voice channel may itself require a guard band therefore that requirement is a COST that the 'other VDL mode' must bear...	Noted
386	Easy Jet	9	Technology Assessment	5.2.1.14 Mode S Recommendation	Cost - what is the cost of Mode S ES to achieve this?	Costs are included in Step 1
387	Easy Jet	8	Technology Assessment	5.2.1.14 Mode S Recommendation	Voice - The whole concept is move digital data to remove all the shortcomings of voice... This however may be necessary as 2 <sup>nd</sup> check in 'early' days where pilot could have CPDLC-0 instruction which is manually input into FMS. Later FMS's would take instruction in directly with pilot monitoring.	Noted
388	Easy Jet	6	Technology Assessment	5.2.1.14 Mode S Recommendation	Channels - In theory, as datalink use increases, voice demand will decrease; what work has been done to assess this? Critical for spectrum capacity.	NOT IN SCOPE. But note that demand for voice channels is also driven by airports. Hence we may need any channels freed from en-route for terminal/airport. The amount of space in the VHF band for data will always be limited.

389	Easy Jet	6	Technology Assessment	5.2.1.16 Conclusion	This is far too general i.e. each item needs to be referenced to technology driving comment e.g. Number of Channels for VDL4 is 3 in both high and low usage scenarios so is well within stated 6 (means 12 if guard bands considered?)	Noted. Some additional comments added
390	Easy Jet	6	Technology Assessment	5.2.2.1 Maturity	This table is very general. Gatelink is missing	Added
391	Easy Jet	2	Technology Assessment	5.2.3.1 Complexity	VDL2 - No Issues? Do not agree. Guard Bands is one for sure i.e bandwidth for one VDLm2 channel is in fact 37.5khz (assuming guard band shared with adjacent channel)	Added
392	Easy Jet	2	Technology Assessment	5.2.3.1 Complexity	VDL4 - Integration with VDL4 with an airframe is not a proven issue. Eurocontrol Report VM4AAS_D3.2 must be part of this report This issue needs a full assessment in the Datalink Roadmap Report.	Discussion added
393	Easy Jet	9	Technology Assessment	5.2.4.2 Costs	Baseline Assumptions. These need explaining as effect on outcome is significant	Added
394	Easy Jet	9	Technology Assessment	5.2.4.2 Costs	Source of these should be transparent also if budgetary versus 'commercial quote' CRITICAL. Why maintenance delta between V2 and 4?	Maintenance is a flat assumption of 10% of initial cost.
395	Easy Jet	9	Technology Assessment	5.2.4.2 Costs	Installation - Describe content of this	See Annex C
396	Easy Jet	3	Technology Assessment	5.2.6.1 Initial link	VDL2 is more mature.... relative; VDLm4 has over 100,000 hours of operational experience. VDL2 is not yet in full operation.	Noted
397	Easy Jet	3	Technology Assessment	5.2.6.1 Work Required	Same comment for VDL2...	Noted
398	Easy Jet	6	Technology Assessment	5.2.6.5 Broadband	Please expand...	Added
399	Easy Jet	3	Technology Assessment	5.2.6.6 Gatelink	Not correct; this is part of CDM supply chain...	Footnote added
400	Easy Jet	7	Technology Assessment	5.3.3.1 Step 2	If VDL4 could do this then it 'simplifies', in part, the overall supply chain of CAP and SAP; use of non VHF media then implies need for two methodologies and costs...	I have removed the non-VHF rider.
401	Easy Jet	10	Technology Assessment	5.3.4.1 ASAS	This para needs checking with the MA-AFAS and ASAS teams...	This is still an industry accepted position
402	Easy Jet	2	Technology Assessment	5.3.5.2 Frequencies	This should say 16 frequencies i.e cannot 'exclude' guard bands	Added
403	Easy Jet	3	Technology Assessment	5.3.5.3 VDL3	Mention of this is distracting; it is unlikely to be used in Europe in the foreseeable future	Noted, but other comments requested it.
404	Easy Jet	6	Technology Assessment	5.3.6.2 2015	Time Critical Messages - Does this refer to total transit time? Expand on 'time critical'...	No, just to the deterministic nature of the QoS
405	Easy Jet	2	Technology Assessment	5.3.6.2 2015	Continued Voice - Believe if efficient use of datalink made then voice (reduced requirement) may well be adequately served; rate of voice growth and release of capacity due use of datalink needs to be included in Section 4.4.2 Evaluation scenarios	See previous comment
406	Easy Jet	8	Technology Assessment	5.3.6.2 2015	High Bandwidth This requirement has nothing to do with this report; it is operator-specific with regard to product offered to customer i.e In Flight Entertainment; needs to be removed	Footnote added
407	Easy Jet	3	Technology Assessment	5.4.1 VDL2	please define 'mature'. effective data rate for enroute is given as 1200 bps in F.1.15 'Strong' support; expand on strong; specifically who when etc. Para 4 – 2015; Scenario A, B, C only show support for Step 1 on own; it can only survive if supplemented by up to two other media on these scenarios. Para 5 – PETAL 2; 95% is a very low service delivery figure... 80 seconds is unacceptable...	Some changes added
408	Easy Jet	1	Technology Assessment	5.4.1 VDL3	Makes no sense as data throughput is low; is voice focussed but understand voice sub channels can be transferred to data...	3T is a good datalink only solution but does not have the flexibility (broadcast, air-air) of VDL4
409	Easy Jet	1	Technology Assessment	5.4.1 VDL4	AOC communications; clarify meaning of last sentence	Footnote added
410	Easy Jet	1	Technology Assessment	5.4.1 Gatelink	This is an important component for this report to consider. This media can serve to unload 'airlink' at airport	Added
411	Easy Jet	10	Technology Assessment	6.2.1.3 Media for Enhanced Surveillance	'as the current message definitions do not contain the required parameters'; please expand this statement to discuss if they could contain required parameters	added
412	Easy Jet	3	Technology Assessment	6.2.2.2 Standards Development - AEEC	This process is underway (promoted by LFV); likely significant progress this year.	Noted
413	Easy Jet	9	Technology Assessment	6.2.4 Cost Assessment	All these costs should be available in a spreadsheet to allow sorting, what-if and sensitivity analysis by all using same criteria	Noted
414	Easy Jet	9	Technology Assessment	6.2.4.3 Ground costs	Suggest VDL4 needs revisit as factor of 2 seems excessive.	Values as provided by manufacturer.

415	Easy Jet	6	Technology Assessment	6.3.1.2 Wording	VDL4... 'could'; should read 'can'.. meet long range requirements once VHF channel rationalisation occurs	Added
416	Easy Jet	9	Technology Assessment	6.3.2.2 Multilateration	Need to discuss effect of resulting complexity and associated cost; do not it is as simple as saying 'offer a credible alternative' without examination	More added
417	Easy Jet	7	Technology Assessment	6.3.2.4 Vehicle Equippage	Alternative systems miss the point of ADS-B i.e. all see all. From an operator perspective, avoidance/reduction of ground accidents between aircraft and vehicles is a significant issue. Rate is growing and severity is often devastating to aircraft and operators schedule; costs to restore are substantial	Noted, but
418	Easy Jet	6	Technology Assessment	6.3.2.6 1090 & UAT	Either they can do job or not i.e. results were not successful? Alternative question; with best will in world will they do job or not i.e. is there a fundamental gap anywhere?	Noted
419	Easy Jet	1	Technology Assessment	6.3.2.7 Capacity	This is a very positive feature of VDL4 i.e. ability to provide flexible solutions	Noted
420	Easy Jet	6	Technology Assessment	6.3.3.1 800 aircraft	Where in the world would 800 be the case? i.e. identify airports	This is the Core Europe requirement for 2010
421	Easy Jet	8	Technology Assessment	6.3.3.3 Infrastructure Rationalisation	Helpful to qualify 'significant'...	Unknown, some estimates indicate upto 30% less Gs needed if ADS-B used as well, but further work is needed
422	Easy Jet	6	Technology Assessment	6.3.3.4 Antenna Blocking	Is this a reason for 6.3.2.6? sounds a bit of a showstopper....	Yes
423	Easy Jet	3	Technology Assessment	6.3.3.5 Channel Management Scheme	Understood this had been done to some degree? Know SAAB Transponder tech were into this some 3 years ago....	Not to the current requirements, still an issue as to how best to arrange frequencies in Europe.
424	Easy Jet	6	Technology Assessment	6.4.1.4 Equippage	'likely'; expand please	AIRBUS and BOEING, Rockwell Collins and Honeywell all make this contention, it is the way they have designed the next generation of transponder.
425	Easy Jet	5	Technology Assessment	6.4.2.1 ASAS	Refer MA-AFAS and ASAS FP 5 & 6 projects. What is the evidence that re-use of TCAS receiver does not degrade this system?	Notes added
426	Easy Jet	6	Technology Assessment	6.4.2.2 New Aircraft	agree. Whole scene will improve if new operators can get this option 'asap'	Noted
427	Easy Jet	7	Technology Assessment	6.4.3.1 App4b	... then VDLmode4 should be changed added as media for step 4 Scenario Tables	Noted
428	Easy Jet	6	Technology Assessment	6.4.4.2 Potential Solutions	Add VDL4 DUAL system	Dual VDL4 is implied anyway, you will not get away with single equippage, what we are after here is a completely different media with different failure modes and propagation
429	Easy Jet	3	Technology Assessment	6.4.4.3 1090ES >2010	This is very significant; for operators taking significant deliveries of new aircraft, we will be throwing out 1090 before delivery stream is complete....	Noted
430	Easy Jet	6	Technology Assessment	6.4.4.6 CDMA	Do not understand the rationale. Surely S-TDMA is the well proven option to maximise capacity by 'controlled operation'	TDMA is certainly a step up from CSMA, but CDMA is another step up in terms of frequency re-use, but it has other issues and full investigation is needed
431	Easy Jet	3	Technology Assessment	6.5.1	NOTE: to uplift these, VDL2 is of no use; i.e. either operators have V2 & V4 (assuming 1090 costs and short operating life discount it), or they use V4 ONLY	Noted
432	Easy Jet	3	Technology Assessment	6.5.1	1090 - "may even require, a concerted rationalisation of the SSR..."; this needs substantial amplification if costs are involved; affects roadmap. ....possible interference with TCAS; needs clear technical pronouncement on this	Noted
433	Easy Jet	1	Technology Assessment	6.5.1	VDL4 -'... has the lowest capacity; where is data supporting this? Note: I have been advised (CNS Systems) that it is possible to combine two channels to get 50khz/228,000bps; is this an option here? Airborne VHF issues occur with ALL VHF datalinks; (the only difference is that VDL4, because of it's design can carry ADS-B and as such will enable regular transmissions to support ADS-B). This is very much an open technical question; the Eurocontrol investigation being done by Honeywell is an essential companion document to this roadmap; both must be assigned to get full technical picture. 'at least 4 frequencies are required in core area i.e. it is very spectrum efficient.	For ADS-B, the issue is the number of targets that can be accommodated. VDL4 is limited by the bandwidth (25Khz as opposed to 1 MHz used by the other media.
434	Easy Jet	6	Technology Assessment	6.5.1	REQUIRED - A table showing all VHF channels in use/allocated in core area in 108-136mhz 'could be in widespread use by 2006'; this is significant	Noted - unfortunately we do not have this information to hand (ie voice was not in scope)

435	Easy Jet	3	Technology Assessment	6.5.1	UAT - Realistically, we must ignore UAT for the short to medium term... even so, because it was designed for a limited range of services it is yet another silo solution to aeronautical enabler needs.	Noted
436	Easy Jet	2	Technology Assessment	6.5.3	'possibilities...'? i.e much is unknown here i.e time, cost, technical effectiveness. 'simulations'... ditto to above. VHF frequency is NOT a VDL4 ISSUE. It is an aeronautical spectrum issue. Multi-link architecture = complexity = time = cost etc etc	Noted
437	Easy Jet	8	Technology Assessment	7 scenario selection	Noteworthy that ONLY VDLm4 does all scenarios except 5b (see earlier query re channel combining to do this)	Noted
438	Easy Jet	2	Technology Assessment	7.2.1.1	Step 1 - VDL2; six frequencies; this is the TOTAL required for VDL4 for all uses. (2 global, 2 regional, 2 local; possible benefit from another 2 though.)	Scenario Scoring has not been
439	Easy Jet	3	Technology Assessment	7.2.1.1	Step3 - Airlines will not support such short term solutions... ie 5 years in reality	
440	Easy Jet	2	Technology Assessment	7.2.1.1	Step 4 - VDL2 is a net waster of frequency; should be bypassed as medium/long term solution	
441	Easy Jet	8	Technology Assessment	7.2 Scenario A	What on earth are we saying here? After 10 years of research costing in region of 200m euro, introduce VDL4 in 2015? i.e. 25 years to launch an application based on VHF technology... RIDICULOUS...	updated due to lack of
442	Easy Jet	8	Technology Assessment	7.3 Scenario B	Fanciful; UAT is very unlikely to be deployed in Europe; frequency availability is huge issue and global interoperability score is too high at 3; should be 1 or 2....	consistently across comments
443	Easy Jet	8	Technology Assessment	7.4 Scenario C	Benefits; definitely not 3; more like 2... Frequency; 4 is unreal; 2 is more correct...	
444	Easy Jet	8	Technology Assessment	7.5 Scenario D	this is the most logical i.e one enabler does almost all (possibly all) applications (refer Conclusions Table 8.1).	
445	Easy Jet	8	Technology Assessment	7.5 Scenario D	Benefits; score of 3 is not appropriate. Reasons: Step 1 & 2 delayed; presumably this is based on assumption that VDL2 is available? At present VDL2 network is does not exist as operators are not convinced it gives sufficient benefits for extra cost (\$35,000/aircraft above ACARS/VDLmA). What exactly is doubt that VDLm4 cannot support ADS-B in core Europe? Capacity is not the issue; waste of spectrum is, is it not? VDLm4 must NOT be tarred with the lack/waste of spectrum issue; Score should be 4; if properly supported as best solution could be 4.5 or 5	and lack of agreement on key criteria. The initial analysis
446	Easy Jet	9	Technology Assessment	7.5 Scenario D	Costs; ok	
447	Easy Jet	8	Technology Assessment	7.5 Scenario D	Frequency; this score should be 4 or 5; this is a bureaucratic issue; support for use of the navigation band is growing; in fact the divisions of nav/comms/voice in the aero band may well be archaic....	stands as a first attempt at
448	Easy Jet	8	Technology Assessment	7.5 Scenario D	Global interoperability; what exactly is 'non-European plans? There are significant European plans; score should be 3-4	
449	Easy Jet	8	Technology Assessment	7.5 Scenario D	Voice; the only reason VDLm4 is not doing voice is the SARP's never originally envisioned it. The is no technical reason why it cannot be used. Believe what we need is DSB-FM voice. This should be scored 4-5.	deriving a solution, but issues
450	Easy Jet	8	Technology Assessment	7.5 Scenario D	Non-ATC; Score this as 5. VDLm4 is the most efficient AOC medium. New operators would use VDLm4 exclusively	
451	Easy Jet	8	Technology Assessment	7.5 Scenario D	NEW TOTAL SCORE IS 78 (Benefits; 4x4=16; Cost; 5X?4 = 20; Frequency; 4x4=20 Global; 3X3=9; Voice; 4x2=8; AOC; 5X1=5)	such as stakeholder commitment
452	Easy Jet	8	Technology Assessment	7.10.2 Notes on Conclusion	How can we say because VDL 2 spectrum has been allocated then the best technical solution is penalised. VDL2 WASTES spectrum. Also, no VDL2 system exists or are any airlines using it....	
453	Easy Jet	8	Technology Assessment	7.10.2 Notes on Conclusion	Table 8.1 says it all; only one technology 'does all'... this does not however preclude operators who have other means available due to previous capital investment, from leveraging that investment.	also need to be considered at
453	Easy Jet	8	Technology Assessment	7.10.2 Notes on Conclusion	How about an approach on the overall subject, that considering what is reasonably available in short/medium term and is applicable to Europe, describing an ideal datalink then supporting this with means of achieving using other technologies for those who have alternative but old technologies?	this stage.
454	Easy Jet	8	Technology Assessment	8.1.1 Table 8.1	Say's it all; only VDL4 does it all. So, what is Europe going to do to accelerate the use of the best long term enabler?	Noted

455	Easy Jet	8	Technology Assessment	8.3.1 Assessment of Broadcast Technologies	Given that the fundamental basis of the report is safety and capacity, the fact that VDL2 cannot assist broadcast surveillance, it should be 'put on the back burner' before it is seriously implemented, incurs costs, then has to be withdrawn over time...Re-emphasise; there is no real need to evaluate implications of two datalinks on one airframe...	Noted
456	Easy Jet	8	Technology Assessment	8.4.1 Scoring	What recent decisions have given VDL mode 2 and 1090 a significant advantage?	Section deleted
457	Easy Jet	8	Technology Assessment	8.4.2 Risky	'inherently risky'; not what we want in airlines....	Section deleted
458	Easy Jet	8	Technology Assessment	8 Overall	Needs summary of point to point and broadcast to be 'even handed'	
459	Easy Jet	6	Technology Assessment	9 Abbreviations & Acronyms	Glossary Items Needing to be Added or Expanded.. ACC – refer C2.3.1.5)...Regional operators (5.4.1 VDL4 page 62)... ACRONYMS (repeated from General)...Acronyms are a virus that prevents understanding. Aviation is rife with them, many having numerous meanings. A real impediment to understanding. Where possible they should NOT BE USED. Word processors don't care about a few extra words. Use of more advanced means such as spreadsheets would significantly cut down the overall number of words anyway...GLOSSARYACRONYMS (repeated from General)...Essential. There is a continuing assumption that all readers clearly understand the terms used. Again use of the helpful elements of modern technology are needed e.g hyperlinks. See end of this document for terms noted as needing adding or definition	
460	Easy Jet	6	Technology Assessment	B.3.1 Quality of Service	Where is this fully defined?	Assessment Framework
461	Easy Jet	6	Technology Assessment	B.3.2.1.1 Transit Delay Indicator	95%.... 'appears to be a representative indicator'; please discuss; seems to stem from current network provider achievements...	Noted
462	Easy Jet	6	Technology Assessment	B.3.2.1 Volume/ATN Priority & Congestion Control	Surely end to end priority control is a fundamental design requirement of any viable datalink solution? How else can we guarantee time critical messages, say CPDLC for course change in busy airspace, is going to arrive and be confirmed in a timely manner?	Noted
463	Easy Jet	6	Technology Assessment	B.3.2.2.3 PDU's	How much real data can a PDU carry?	PDU size is dependent upon the protocol layer and technology. Typically 512 - 128 bytes
464	Easy Jet	6	Technology Assessment	B.3.3.1 Transit Delay	What is delay for VHF voice?	< 0.2 seconds,
465	Easy Jet	6	Technology Assessment	B.3.4.1 ATN Prioritisation	Ref B.3.2.1....	Noted
466	Easy Jet	9	Technology Assessment	C.2.2.1.3 Assumption	Why assume retrofit as baseline; start with initial fit, probably the most effective way then deal with exceptions....	Noted
467	Easy Jet	9	Technology Assessment	C.2.3.1.3 Assumption	Why should mitigation be via use of different system. Is it not perfectly reasonable to provide redundancy with a duplicate system? Simplifies installation, rotateable spares, troubleshooting etc etc	Noted
468	Easy Jet	9	Technology Assessment	C.4.7.2 V2 Ground Stations	Are both ARINC and SITA going to install 150 ground stations each? If so then the cost is double.	Noted
469	Easy Jet	9	Technology Assessment	C.4.17	This section needs serious rework... there is a lot being said in too few words...	Noted
470	Easy Jet	9	Technology Assessment	C.4.17.2	The assumption here needs critical review; it does not consider other valid baselines	Noted
471	Easy Jet	9	Technology Assessment	C.4.17.5	Why 2 new antennas? What is wrong with 1 VHF 3 existing? (single system)	Noted
472	Easy Jet	9	Technology Assessment	C.4.20.2	Gatlink as described by ARINC 763 suits US airlines that own their own terminals or large airlines having fixed terminal/gate access i.e. it incurs significant infrastructure costs plus requires a file server on board. IEEE 802.11 is far more useful and cost effective.	Noted
473	Easy Jet	9	Technology Assessment	C.5.1.1 ATN Network Costs	Routers; number required in Europe; surely there is an opportunity to significantly reduce this under Single European Sky FIR etc rationalisation. Application server cost of 475,000 euro; wow. Cost overall; this needs serious rethink when talking such large sums and associated probable long timeline. This is where use of an IP derivative for ATN make so much sense....	Noted
474	Easy Jet	9	Technology Assessment	C.5.1.3.2	These are very large costs but they are estimates. The number of ACC's probably could be reduced for other reasons leading to cost reductions here. Very expensive server/processors...	Noted

475	Easy Jet	9	Technology Assessment	C.5.2.2	ATCO's are in short supply now, evidenced by delays in summer 2002 in UK. SES must offer opportunities to improve via reduced ACC's, better, tools etc and so ensure no skill shortage/better productivity/ANSP cost containment or reduction.	Noted
476	Easy Jet	9	Technology Assessment	C.5.2.3 Cost	680m euro. This must be challenged via the assumptions and path chosen that causes this much cost.	Noted
477	Easy Jet	9	Technology Assessment	C.6 Cost summary	This needs to be reworked to show cost of a solution that supplies both broadcast and point to point in one package	Noted
478	Easy Jet	9	Technology Assessment	C.6.1.2 Significant Cost	An example of mandating at whatever cost by those who don't bear the cost. The proper way forward is to specify information required and then let industry/users provide it at best cost i.e. not lock in costs that operators cannot escape because there is only one mandated option. 'Significant network and ATC upgrade costs...' – ensure we understand these clearly.	Noted
479	Easy Jet	9	Technology Assessment	C.6.1.3 Costs	It is not correct to assume mode S ES is nil cost just because some states have seen to mandate it. See C.6.1.2	Noted
480	Easy Jet	9	Technology Assessment	C.6.2.1	Note 2 - This assumption is misleading as it does not apply to say, Boeing aircraft. Operators are having this forced on them in much the same way that ACAS and GPWS were; mandate with single option. VDL4 could readily supply the same data without Mode S ES. For us this is serious money over 240 aircraft	Noted
481	Easy Jet	9	Technology Assessment	C.6.2.1	VDLM4 - Our information suggests this cost is too high. Manufacturers need to update this figure.	Done
482	Easy Jet	9	Technology Assessment	C.6.5 980m euros	either they can do job or not i.e. results were not successful? Alternative question; with best will in world will they do job or not i.e. is there a fundamental gap anywhere?	Noted
483	Easy Jet	1	Technology Assessment	APPENDIX F VDL2	Overall the VDL2 information is telling; low Effective Data Rate with significant waste of spectrum	Noted
484	Easy Jet	1	Technology Assessment	F.1.10 Theoretical throughput	In all cases the theoretical data rate should be reference only; all discussion should be based on Effective Data Rate	Noted, general work done to address this
485	Easy Jet	3	Technology Assessment	F.1.2 Ground Infrastructure	This means that VDL2 is not yet available. Do both SITA and ARINC propose 150 ground stations providing the same service, each requiring separate channels; where is the spectrum?	ARINC and SITA plans added
486	Easy Jet	2	Technology Assessment	F.3.1 Frequency availability	The Note says it all; this solution is not viable	Noted
487	Easy Jet	1	Technology Assessment	F.3.2 Q of S	How can we use a system that has no/limited Q of S or Priority control?	General changes made
488	Easy Jet	1	Technology Assessment	F.3.3	R&D - How can this be promoted as a solution when we don't know if it will cope under load? This is a showstopper.	Noted
489	Easy Jet	1	Technology Assessment	F.3.3	Certification - 'depends on market opportunities.....' – yes.	Noted
490	Easy Jet	3	Technology Assessment	F.3.3	System Deployment & Ac Fitment- See previous comment; this is unlikely to happen	Noted
491	Easy Jet	1	Technology Assessment	F.6 Conclusions	Strong - This is not neutrally phrased... yes, high compared with ACARS but low by a factor of circa 4 or more compared with VDL4.	Agreed - comment added
492	Easy Jet	1	Technology Assessment	F.6 Conclusions	Weak - QoS, Prioritisation, message delivery guarantees... these are fundamental requirements of a system that is going to affect safety of life.	Agreed
493	Easy Jet	1	Technology Assessment	F.6 Conclusions	Conclusion - All based on possibilities.	Agreed
494	Easy Jet	1	Technology Assessment	G.3.1 General	No ATN compliance, no multiple QoS, no Priority management....Capacity; not adequate at 40nm; not far in time terms....Coverage; Notes are cause for concern....	Agreed
495	Easy Jet	1	Technology Assessment	G.6 Conclusion	4 years after possible widespread use it's weak characteristics will override...	Agreed
496	Easy Jet	1	Technology Assessment	H.3.1 General	Frequency - How ion earth can this be mandated when the impact on other systems i.e. TCAS, Mode S Elementary and 1090/ADS-B/TIS-B are yet to be assessed?????	NOT IN SCOPE
497	Easy Jet	3	Technology Assessment	H.3.3 Maturity	Operational Trials - 'partial', 'experiments', for a mandated system?????	Agreed - comment added in conclusion
498	Easy Jet	3	Technology Assessment		Mandatory - This should be withdrawn until the serious open technical questions are answered and provision is made of supply by alternative methods	NOT IN SCOPE
499	Easy Jet	6	Technology Assessment	H.4.2.2.1 Airbus	We need Boeing input too...	Boeing did provide input in some areas, but not all
500	Easy Jet	6	Technology Assessment	J.1.2	Remove word 'some'	Added

501	Easy Jet	6	Technology Assessment	J.1.14 Data Rate	Negative impact of a lower data rate; lower than what?	VDL2 = 31.5 KHz, VDL4 = 19.1 kHz.
502	Easy Jet	6	Technology Assessment	J.1.15 Performance	This report answers some of these questions....	FUTURE ACTION
503	Easy Jet	6	Technology Assessment	J.1.19 Eurocontrol/Honeywell Report	This is an essential part of this report. The report is just getting stakeholder input and is being challenged in a number of technical areas.	Added
504	Easy Jet	6	Technology Assessment	J.3.2 QoS	'Specifically designed for multiple....'; this is proper use of technology. Effective Data Rate; significant leader here. Very High Integrity...Priority management to the 15 ATN levels...	Agreed
505	Easy Jet	6	Technology Assessment	J.4.2.1 Baseline	Why use OLD technology as a baseline?	Costs presented are for installation of VDL4 from scratch.
506	Easy Jet	6	Technology Assessment	J.6 Conclusions	Weak; low capacity; please show all methods capacity etc...	Added
The following comments were received after the workshop						
507	STNA	3	Technology Assessment	Table 6.1	ED-102 has not been updated. DO-260, the RTCA counterpart, has been updated and approved last January. Regarding the equipment development, there are already some equipment available and they are more than prototypes. I believe this table has to be updated accordingly.	Done
508	STNA	3	Technology Assessment	Table 6.2	I believe that there are still issues to be solved with VDL mode 4. For example, the slot re-use functionality does not seem very explained in the interim MOPS and may have serious safety impact if not solved. Furthermore, I am not sure that interoperability tests with equipment from different manufacturers had been performed. This is also a major item to clarify.	Done
509	STNA	3	Technology Assessment	Table 6.7/6.8	Tables 6.7 and 6.8 are misleading. VDL mode 4 and UAT will benefit from initial implementation of 1090 ES (CDTI, FMS update, training...). This must be clarified in order not to confuse people.	I agree, but the costs are presented for all media as a first implementation. I think this point is valid and need to be made elsewhere in the document - I will add the sentiment somewhere
511	Eurocontrol (DIS/ATD Unit)	1	General	General	1. Even the 'experts' appear to disagree on the figures, so the performance in terms of bit-rate throughput of the various data link technologies cannot easily be compared. Experience with similar technologies (e.g. LAN technologies) has shown that the greatest gains occur where the industry makes the greatest investments, and these gains can be as much as a continuous cumulative increase of 50% more performance every year. For both these reason, we believe that current bit-rates are not a valid basis for comparison of the technical options, and we recommend that it would be better to consider that the level of industrial commitment is the main driver and the prime criterion for comparison of the technologies.	Agreed in principle, but such changes would unfortunately require standardisation work and would probably have to be a new VDL.
512	Eurocontrol (DIS/ATD Unit)	1			2. The data to be downlinked is destined to enter various processing systems on the ground. Almost all of these ground-based systems use CSMA-type Ethernet LANs, in even their most safety-critical portions. This demonstrates firstly that CSMA protocols are suitable for safety-critical applications, and also that it would be over-engineering to insist that the air-ground part of the data processing chain must have a non-CSMA type of protocol (one of the main arguments for VDLM4 versus VDLM2).	Use of Ethernet LANS is quite different from air-ground datalinks where collision detection can not be guaranteed. CSMA/CD at low loads (eg 20%) is considered safe on the ground, but the years of experience before this was excepted will need to be repeated for the air/ground case.
513	NATS	8	General	General	1. It is unlikely that 75% of European ACCs will be VDL M2 capable by 2006 (Step 1). NATS would suggest 20% is more likely by 2006 and it will probably be 2010 for a 75% ACC capability of early a/g ATM apps. Once equipped for early a/g datalink apps, it is likely that 'bedding-in time' will be required and thus the duration of each step is likely to be longer than the plan currently proposes.	
514	NATS	8	General	General	2. NATS believes that the assumed airline equipage rate is also over ambitious and is likely to be slower - e.g 75% equipped for VDL M2 by 2010 rather than ~2006.	
515	NATS	1	General	General	3. NATS believes that VDL M2 will meet a/g data requirements for at least another decade. We believe that the identified max. throughput of 3kbps for VDL M2 is too low. Should there actually be a shortfall, this should be addressed with extra VDLM2 frequencies rather than a new a/g subnet technology that will require a complete air and ground refit (i.e. VDL M4).	Noted.

516	NATS	2	General	General	4. NATS believes that Europe should avoid a proliferation of a/g data communication links, thus there is no real need for VDL M4 in that timeframe. There are still sufficient technical concerns about the viability of VDL M4 to make it unwise to base a future European a/g communications strategy on this technology at this time.	Noted
517	NATS	2	General	General	5. For step 4, NATS would endorse the advancement of the next generation comms system instead of introduction of VDL M4 as a comm link. NATS also believes that step 4 is likely to be delayed naturally beyond the current dates in the plan (see comment 1) thus there is no need to actively delay introduction of step 4.	Noted
518	NATS	3	General	General	6. NATS supports us of 1090 ES for step 5a.	Noted
519	NATS	6	Datalink Roadmap	General	Although this does include general purpose datalink applications using both CNS/ATM-1 and FANS-1/A, the general thrust of the document is still heavily-oriented (too much?) towards ADS-B type applications.	Noted
520	NATS	9	Datalink Roadmap	General	There is a tendency to take one example (eg Final approach spacing at Arlanda airport), extrapolate it across Europe as a whole and claim all the benefits for ADS. This fails to recognise that there may be other ways to obtain the same benefits (to take the same example, equivalent separations are already being achieved at Heathrow using existing means).	Noted
521	NATS	9	Datalink Roadmap	General	A valid cost benefit case will need to be made before the proposed application(s) are introduced in a particular FIR. Some applications are likely to give more benefits in particular FIRs and are therefore likely to obtain higher priority in these areas than other applications which do not give any benefit. Thus, any roadmap can only be an outline framework within which individual ATSPs work and is unlikely to be rigidly followed by all ECAC States.	Noted
522	NATS	8	Datalink Roadmap	3.3.5	In general, the suggested sequence of steps looks reasonably compatible with what is actually happening at present. However (ref 3.3.5), it is likely that ADS-B will be introduced first in more remote and fringe areas to gain operational experience with its use before it is migrated into high density airspace in core Europe. It is unlikely that ADS-B will start to replace the current SSR coverage in the core area for many years to come.	Noted
523	NATS	10	Datalink Roadmap	7,11	It should also be recognised that the study does not address the institutional and liability issues associated with any delegation of responsibility for maintaining separations to the flight deck. This is understandable since such issues are not appropriate for this Study which is mainly addressing technical issues. However, readers need to be aware that other issues exist which have not yet been resolved since these could also affect timescales. It is suggested that a para should be added to 7.11 to record this.	added in section 7.8
524	NATS		Datalink Roadmap	4.1.2.1	FANS-1/A is also supported by VHF DL when within VHF coverage. Note also that, since the start of the FAA CPDLC Build 1 trials in Miami in October 02 (also planned for Eurocontrol Link 2000) this technology can be moved from 4.1.3.2 to be another bullet in 4.1.2.	VHF Added,
525	NATS		Datalink Roadmap	4.2.1	Likely that SDLS will be one possible variant of NGSS.	Noted, this is intent
526	NATS		Datalink Roadmap	4.2.1	AMSS also provides an ATN compatible subnetwork (Data-3)	Added
527	NATS		Datalink Roadmap	4.2.1	Do not understand or agree with comment that "VDL2/ATN does not support long term goal of tactical datalinks". They meet the requirements as currently defined by ICAO.	Disagree, otherwise ICAO would not support VDL3 and VDL4
528	NATS		Datalink Roadmap	4.3.1.1	Disagree with the statement that there will be no suitable frequency available for UAT in Europe before 2006. The US has already identified a frequency (978 Mhz, the lowest DME frequency that can be coordinated on an international basis) which is paired with the 108MHz VOR frequency. In general 108 MHz is not used due to the problems associated with the sound broadcasting services directly below it. Therefore it is highly likely that the DME frequency identified for UAT could be made available very quickly on a global basis.	Comment added
529	NATS		Datalink Roadmap	4.4.2	AMSS is also available to support Step 1.	Not included in the table as it supports only a fraction of the requirements. AMSS is supported for its current uses.

530	NATS		Datalink Roadmap	5.2.1.2	While FANS-1/A is currently the main aircraft equipage in support of oceanic/remote applications, it can be foreseen that with increased CPDLC/ATN equipage in future for domestic applications (FAA - CPDLC Build 1 and Eurocontrol - Link 2000), pressures will develop (as they did with FANS-1/A in the North Atlantic) to be able to "accommodate" CPDLC/ATN technology in oceanic & remote areas as well.	Added
531	NATS		Application Roadmap	3.4.3 App 10a	Current opinions on the North Atlantic are that ADS-C and CPDLC will be the main essential enablers for improved ATS. ADS-B is currently seen as a "nice to have" and might be used if a manoeuvre was needed involving aircraft that happened to be ADS-B equipped for use in other Regions. However, ADS-B is not currently believed to be essential	
532	NATS		Application Roadmap	3.6.2.2, App 14a	ADS-C can also be used for surveillance in remote regions where a lower update rate will not be so critical. When this is used in conjunction with satcom, no ground infrastructure in the remote region is needed whereas ADS-B via 1090ES, VD4 or UAT would all require some ground infrastructure (albeit cheaper than radars!)	
533	NATS		Application Roadmap	3.6, OC14 table, p44	Currently, in the NAT, the required additional capacity was provided by RVSM and there is no requirement (yet!) for further separation reductions. Note under "cost effectiveness" position reporting is being carried out by FANS-1/A based ADS-C. Pre-operational trials of ACARS based FMC waypoint reporting are likely to start in 2003 but it is too early to say when this will become operational.	
534	NATS		Application Roadmap	OC4 timescales	App 4a may be operational in some areas of Europe within these timescales but it is unlikely to be universally available.	
535	QinetiQ		General Comment	General	The comments that are not able to be incorporated into the document to which they refer should be included as an appendix to that document. This will ensure that the comments are not lost and the report can be read in conjunction with them.	We will consider this
536	QinetiQ		General Comment	General	Discussion at the Workshop was mainly aimed at the Technology Assessment however it would have been useful also to debate the overall Roadmap document.	Noted
537	QinetiQ		Datalink Roadmap	General	Comments made by Airbus seem to reverse some of the conclusions of the study - how will this be addressed in the final versions of the study ?	By inclusion of their comments
538	QinetiQ		Datalink Roadmap	P6 and P 67 - Roadmap diagram	We believe that the transition from technology to technology is far to soon. Technology once implemented remaining in use far longer than shown in the diagram. For example, POA will continue to be used long after 2006 as shown in the diagram - perhaps as long as 2010 to 2012.	Noted, we also see technologies being used for longer, but augmented as required.
539	QinetiQ		Datalink Roadmap	7.3.6	We strongly support the statement that for SATCOM the existing L-band frequency is very important as the other (higher bandwidths) suffer reduced performance in the rain. Aviation should strongly defend access to this band to meet future requirements.	Agreed.
540	QinetiQ		Technology Assessment	2.2	The term AVPAC is no longer used and has been replaced by VDL Mode 2.	Noted
541	QinetiQ		Technology Assessment	2.5	The term NGSS is used by ICAO to mean any future satellite system that is not the current AMSS. SDLS is a potential NGSS. Boeing Connexion is not likely to be an NGSS as there is no intention that it carries ATS or AOC traffic - at least at the moment.	This is also the intent of all but the heading in the Annex, sorry for the confusion. Note added
542	QinetiQ		Technology Assessment	3.3.7	The support of non-safety and regularity of flight communications affects the ability to obtain the required spectrum. AAC is not allowed in the AM(R)S band. Currently access to the L-band spectrum for AMS(R)S is only possible through a Radio Regulation footnote for priority 1 to 6 communications.	Noted
543	QinetiQ		Technology Assessment	4.3.1.3	For satellite based systems space segment providers should also have been included.	Noted
544	QinetiQ		Technology Assessment	4.3.1.4	The definition of CSP is wrong. Your definition covers only the ground segment but it should include the air-ground link too. Typical Service Level Agreements with CSP includes the performance of the a-g link.	Noted
545	QinetiQ		Technology Assessment	Table 5-1	AMSS supports 6 levels of priority of safety and regularity of flight communications (I.e. ATSC and AOC)	AMSS supports 15 levels of priority of which 6 are applicable to the AMS(R)S allocation. Footnote added
546	QinetiQ		Technology Assessment	Table 5-1	The high speed rate of 10.5 Kbps cannot be supported globally without high gain antennas	Footnote added
547	QinetiQ		Technology Assessment	Table 5-12	See comments 557 and 558 below on costs.	

548	QinetiQ		Technology Assessment	P62 - Newcom	The term 'Newcom' is confusing. Is it a totally new system for which no technical details have been given or is used for any new systems in the timeframe of 2015 ?	Noted, we had to call it something.
549	QinetiQ		Technology Assessment	Table 8.1	SDLS supports Uplink Broadcast	Added
550	QinetiQ		Technology Assessment	N.1.1	SDLS is not being developed by Eurocontrol.	Corrected
551	QinetiQ		Technology Assessment	N.1.8	EMS is no longer functional. However Artemis is now is the correct geostationary orbit to offer communication service.	Corrected
552	QinetiQ		Technology Assessment	N.1.11	Fucino no longer supports aeronautical communication.	Corrected
553	QinetiQ		Technology Assessment	N.1.16 to N.1.18	These are design goals and no firm decisions on implementation options have been made at the moment.	Note added
554	QinetiQ		Technology Assessment	N.1.22	Artemis has not been used so far	Corrected
555	QinetiQ		Technology Assessment	Table N.3.1	Frequency Availability - Access to L-band spectrum for AMS(R)S is guaranteed under a Radio Regulation Footnote. The possibility of sharing arrangements within the MSS is still under discussion in ITU.	Added
556	QinetiQ		Technology Assessment	Table N.3.3	ICAO activity - The recent meeting of AMCP/8 has agreed to restart activity on NGSS including SDLS/NexSAT systems.	added
557	QinetiQ		Technology Assessment	Table N.4.1	Under the SDLS concept there is no intention to launch satellites but it will reuse existing space segment e.g. Inmarsat or regional systems. Therefore it is not correct to include these costs.	Added as note under table
558	QinetiQ		Technology Assessment	Table N.4.2	The costs for avionics are much higher than anticipated. The cost of an Aero-I system is not a good example. Aero-L would be closer but with a much larger sales base.	Added as note under table
559	QinetiQ		Technology Assessment	N.6	"Does not utilise modern space segment engineering". We do not agree with this comment - the SDLS design is not finalised however it the demonstrator uses the latest COTS products. Please provide more vidence.	The point is that SDLS is based around an existing transparent payload. Modern techniques would use a regenerative payload which would increase available throughput and provide higher signal gain at the satellite. I can provide more information if required, but in this report I have merely expanded the note.
560	QinetiQ		Technology Assessment	N.6	"The PTT voice delay need to be verified by simulation" - the SDLS demonstrator has provided measured times which meet the design goals.	I have deleted the point as I do not think the PTT voice delay is a concern for a GSO system
561	QinetiQ		Technology Assessment	N.6	"The polling service is not aligned with other ADD developments" . The final protocol is still being defined - the final system may look very much typical ADS-B systems.	Added.
562	LVF		General	General	The Draft Executive Summary dated December 2002 and the 2nd version of the Data Link Road Map pushed by AIRBUS does not reflect the operational and technical finding of the study, and should therefore be completely rewritten based on the Data Link Road Map, 30 October 2002 (P167D2010 v 1.0). LVF's comments are therefore based on the 30 October 2002 document.	Noted, we have tried to adress this issue fairly. The new documents move towards the version mentioned.
563	LVF		General	General	It become clear during the discussions on 21 February 2003 in Brussels that the minority opposing VDL Mode 4 does so with other motives than operational, technical and logical facts. It is therefore important that a study undertaken on behalf of the European Commission is filtering comments from those opponents who's interest is based on other criteria than what is in the best interest of the aviation community, the ATM providers and the need for improved safety and efficiency/capacity of the European air transport sector as a whole.	Noted

564	LVF		General	General	The European organisations concerned have so far failed to make timely decisions and that has and will (unless changed?) continue to place unnecessary economical burdens on the aviation sector. One example on that can be found in the European Commissions proposed changes EEG 3922/91 on harmonization and administrative practices in the area of Civil Aviation OPS 1.668 on Airborne Collision Warning System, paragraph 2) which is stating that for operations after 1 January 2005 all turbine engine aircraft with an All Up Weight of more than 5,700 kg or capable of carrying more than 19 passengers shall be equipped with a Collision Avoidance System with performance equal to or better than ACAS II. ACAS II is a very expensive system with limited performance and prices are often exceeding the second hand value of the aircraft on which it shall be installed. And there are no European manufacturers of ACAS II. A VDL Mode 4 system with CDTI could have saved significant amounts of money for those operators, yet providing a wide range of other applications and capabilities. Other examples are the plann	
565	LVF		General	General	General Aviation including sail planes, hot air balloons, Aerial Work and airport surface vehicles are all part of the aviation system. A new type of aircraft –the Unmanned Aerial Vehicle (UAV)- is also gradually being introduced and has to be considered as well. Consequently, the feasibility and willingness to equip with a new system capable of supporting all user groups has to be given high consideration in the Data Link Road Map recommendations. In the Study the approximately 2,000-2,500 European commercial air transport category aircraft are in focus while the other categories representing up to maybe 100,000 units have been given lower priority. This needs to be corrected. They are all part of the aviation system.	Noted
566	LVF		General	General	The European aviation sector is at a cross road with basically two options: (1) Continuing with small steps based on the stretching of outdated technologies that ultimately can make it impossible to implement the solutions that could provide significant improvements of the European CNS/ATM system, or (2) Start implementation of the new systems and concepts that can avoid the forecasted gridlock in the European air transport sector. The many different steps presented in great details in the Study could basically be accommodated in two steps – one with and the other without VDL Mode 4 and ADS-B. LFV/Swedavia have over many years since 1991 successfully demonstrated the feasibility of the second of the two approaches above in projects of which the European Commission has sponsored most of them. The Data Link Road Map study has, like the CEC ATLAS IIA –study did in 1996, provide a systems wide view of the situation thus refocusing from the common stow pipe micro management processes.	Noted
567	LVF		General	General	The maritime sector started the standardisation of the maritime version of VDL Mode 4 – the Automatic Identification System (AIS)- in 1996. Standards have been adopted by ITU and IMO, the AIS system is mandatory for so-called SOLAS ships and decisions have been made to implement a European wide network of AIS ground stations. For security reasons the US President in December 2002 signed a Directive stating that all boats in US costal and inland waters with a length exceeding 8 meters shall be equipped with AIS before the end of 2004.	Added
568	LVF		General	General	Cost comparisons appear to be based on the assumptions that previous decisions cannot be changed. This should be corrected (See e.g. the attached comparisons between the cost of full Mode S implementation versus ADS-B). In addition to capital investment the operational cost should also be considered. An example on that is that a data link system that also supports broadcast applications can result in significant savings for the airlines. A very rough comparison of the potential savings for one airline at one airport in central Europe of broadcasting ATIS information only instead of using the ARINC/SITA network indicated potential savings on the order of one million US\$ per year.	Noted

569	LVF		General	General	Spectrum efficiency is a key issues for the aviation community. To give priority to applications that are of non-critical and administrative nature over ATC and safety related applications must be strongly questioned. It should be further noted that about 50-55 % of the message content in AOC is similar to what is in the ADS-B messages. Thus the implementation of ADS-B and the use of VDL Mode 4 also for AOC messages will further improve the spectrum efficiency compared to a VDL Mode 2 + VDL Mode 4 situation (assuming that both could be implemented on the same a/c). Spectrum efficiency is not just a question of net data rate. The Co-Channel Interference (CCI) value is another even more important factor and indicates frequency re-use capability. Adding the 4,7 times higher net throughput for VDL Mode 4 as stated in the Study to the 4 times higher reuse ration the VDL Mode 4 spectrum efficiency is more than 15 times higher than for VDL Mode 2.	Noted, general comments added on this and further discussion at workshop.
570	LVF		General	General	Security features in the future CNS/ATM systems have to be addressed. They will require a two-way data link capability. Several such features are being implemented in the maritime AIS (VDL Mode 4-like) systems and that could also be done in the VDL Mode 4 aviation systems.	Noted, and added to Mode 4 annex
571	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	General	It is VERY difficult to See why there is a need for all those steps (1-5), each of which separately will delay the introduction of real changes into the ATM world when it is technically and operationally easier to do all in one step at a much lower cost. The cost summaries should add the costs for all steps based on the implementation of the Mode S radar, VDL Mode 2, Mode S data link compared with direct implementation of VDL Mode 4.	Noted
572	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	General	The study seems to be focusing on Air Transport a/c only. There are ~46,000 GA a/c in Europe and the AOPA-EU as well as IAOPA has refused to implement Mode S. There are also many thousands of Ground Vehicles that need to be equipped for e.g. Runway Incursion prevention. What should they have? The future European ATM system needs to include all user groups to improve safety and efficiency.	Noted, and comment added to address this
573	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	General	Compliance with European neighbouring counties such as Russia and the Far East will soon be more important than the westbound since traffic traffic growth to/from Russia and the Far East is likely to be much higher than westbound growth. 2/3 rd of the worlds population is in the Far East and South East Asia.	Noted
574	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Page 14	It is difficult to understand how step 1 CPDLC only will provide an 11 % capacity increase. Especially since e.g. today's ACARS clearances according to the Aircraft Flight Manuals have to be reconfirmed by voice. That looks like a capacity decrease more than an increase. Due to the latency and unpredictable behaviour of VDL Mode 2 (if that's the technology e.g. the French associate with CPDLC) it is not unlikely that the same procedures as today will be in place. Another early implementation application that some airlines have identified is Fleet Management, which can't be done over VDL Mode 2 in Europe.	Figures from PETAL?
575	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	3.3.4	Reliable MTCD can't be done without Trajectory Change Points (TCP's) being transmitted from the a/c. DAP over Mode S is useless for this application.	Noted
576	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	3.3.6	Mode S Enhanced Surveillance implies that the a/c is fitted with a Mode S data link. This has almost unanimously been rejected by the airlines. The US air carriers have got the FAA to abandon Mode S data link since 1996. Europe should be interoperable with US, so why propose something that is useless also in the USA?	Noted, we explicitly rule out the use of Mode S for SVC, but include the Enhance Surveillance supported ny the Eurocontrol program.
577	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	3.4.6&8	Enhanced visual acquisition may be a safety enhancement possibility but may prove difficult to quantify in terms of capacity benefit..	Noted
578	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	3.6.2	The statement that 4D ...operators unlikely to implement 4D RNAV until at least 2015?? This statement is contradictory to surveys made on Users Expectations in e.g. MA-AFAS and MFF. The requirements from those suggested a latest implementation 2007-2008. The 2015 date must come from AIRBUS demonstrating their unwillingness to make any changes to the Aircraft, or otherwise explain or delete!!	Noted

579	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Para. 3.7.	It is difficult to understand why Fusion of current terminal/surface radar is a condition for ADS-B. On many airports there is no surface radar, and if ADS-B is implemented there is no need for fusion of radar. A-SMGCS routing can be done as soon as the right ADS-B technology is in place and don't need to be part of step 5a). It is dependent on a/c having a proper display.	Noted
580	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Table	Any date beyond 2008-2010 should be avoided as they tend to become self-fulfilling prophecies or a justification for doing things over and over again rather than doing the right things from the beginning. Move target dates forward, since we don't believe that aviation is served by prolonging the "waiting list" for operational improvements much in addition to the decade that has passed since the ICAO 10th AN Conf. in 1991.	Noted
581	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	4.1.3.1&3	Mode S ES is more or less consistently opposed by the airlines. FAA abandoned it in 1996. The statement that FAA and Eurocontrol has selected VDL Mode 2 for CPDLC can not be true. FAA has allowed some trials in Miami but has not taken any decision about implementation according to the latest news. The splitting of the VHF spectrum with a portion assigned to ARINC makes it difficult for FAA to deny trials, but with widespread use ARINC is likely to have trouble with FAA to get additional spectrum. FAA Spectrum Office is aware of the VDL Mode 2 problems. Eurocontrol's selection is in our opinion highly questionable and has no relevance to Europe as a whole since individual states makes the decision.	Noted
582	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	4.1.3.4	The FAA "decision" is a decision not to implement ADS-B and the user community has been uninformed about the consequences. JAFTI gives recommendations only.	Noted
583	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	4.1.4.	Delete VDL Mode 3 as a candidate in this context. It can't be implemented, and will not work unless it becomes similar to VDL Mode 4.	Noted, but also note VD3 is not recommended
584	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	4.1.5.1	How can 3G/UMTS (CDMA) be mentioned here? According to extensive studies made by FAA/MITRE in 1996-1998 CDMA can't be used for aviation since it is not possible to solve the near-far problems. Delete also the others, since they have no relevance to ATM. Satellites may be ok for long distance and cabin entertainment, but will not provide any a/c-a/c functions, let alone time-critical applications. Those who have proposed it should give detailed explanations on what applications they are useful for!	Noted
585	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Table 4-1	Delete future technologies. CDMA is not suitable for aviation applications; 3G is a ground based cellular system that for the same reasons as for GSM can not be used in the air, that would saturate the whole system.	Noted
586	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	NGSS, etc	Delete so-called "Future Technologies" from the table. Make a note that a VDL Mode 2 type of data link can only support non-critical applications such as Pre-Departure clearances. It will not off-load the voice channels since according to the Aircraft Flight Manuals all ATC messages received over ACARS has to be reconfirmed by voice!!	Noted, comments on the problems of VDL2 lack of QoS added
587	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	1090ES	If 1090 ES is to be regarded as mature there must be test and validation data available. Where are they?	Noted
588	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	VM4	The reason why VDL Mode 4 has much better performance on the surface is the waveform with longer duration of the bits and its much better multipath performance. It is also less sensitive to shielding. See also other places where the same statement is made. The channel management plan is available from SF21 TLAT material.	Noted
589	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	UAT	The range for UAT has been reduced to 120 nm in accordance with the MOPS.	Comments on UAT range limitation added
590	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Table 4-4	Rework this table. 1090 ES can't serve step 2 applications. It will require Mode S data link which is the same as Mode S ES. Spacing can't be done with 1090 ES in Step 3 since you can't certify a single thread system for ADS-B. Delete 1090 ES, E-UAT and UAT from this table since they have no 2-way capability. Delete also 3G from any and all ATM related functions.	Noted

591	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Table 4-5	Rework the table on the basis of comments no. 20 above.	Noted
592	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Para 4.5	Rewrite the high support for VDL Mode 2. Several countries have decided not to implement VDL Mode 2. Delete ADD via Mode S system. Save pain and money.	Noted
593	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	515/5.1.7	There is no evidence anywhere that VDL Mode 4 would not be sufficient for ADS-B. Should traffic exceed the numbers used in e.g. the SF21 TLAT evaluations we have much bigger problems such as extension of the main airports, etc., but they have no land available for expansion. Statement "none of the applications in the first four steps...? TIS-B can't solve that! It is still doubtful what applications TIS-B can be used for other than "see and avoid" so this should be deleted. Interoperability between pairs of a/c is required. Period. Anyone making suggestions like this lacks understanding of aviation applications and the technology requirements! Note that ATSAW is not an application.	Noted
594	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Page 37.	The ones that is making statements about maturity on VDL Mode 2 seems to believe that a) it can be widely deployed; b) that standards exist, and c) that it has been validated. Where are the data that verifies those statements??	Accepted ICAO position?
595	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	5.2.4/2.5	Second bulletpoint: Delete VDL Mode 3; it is unproven, can't be deployed, wouldn't work as currently specified and will under all circumstances have lower capacity than VM4. Delete CDMA from everything in the report.	Noted
596	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	5.3.2.2	Numerous simulations and test and trials have been made with VDL Mode 4. It is a strange world: Over the last decade hundreds of demonstrations, dozens of simulations and a countless number of studies have been made showing that VDL Mode 4 works for all the advocated applications. Yet, it is placed at the same level of maturity as completely unproven technologies such as VDL Mode 2, 1090 ES, Mode S ES, etc. The number of channels required for VDL Mode 4 are known (just ask or see the SF21 TLAT report).	Noted
597	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	5.3.3.2	If states have made mistakes, that should not be used as an argument in a technical/operational context. Regarding ownership of data as mentioned in para. 5.3.3.5 could not be worth mentioning since similar agreements exist on cross border sharing of radar data in many parts of Europe.	Noted
598	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	5.3.4.3	The only link that has proven to work on the surface is VDL Mode 4. Without making a too long list here are some examples: Gothenburg 1991-1994, Stockholm-Arlanda since 1998-, DEFAMME, MAGNET-B (Shiphol), Atlanta trials 1996-1998, Heathrow tests 2002. So what is unproven? 1090 ES and UAT works very poorly on the ground, that should be highlighted!!	Noted
599	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	5.4.	The number of channels for VM2 should also include AOC? To find out the truth simulations are required before any further deployment decisions are made. Delete VDL Mode 3 and SDLS as alternatives.	Noted
600	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Table 6-2	The table is missing!	added in later versions
601	LFV		Datalink Roadmap (2nd Edition, Dated October 2002)	Tab6.2.6	It cannot be true that Mode S ES is almost free of charge??	Figures provided by AIRBUS
602	Marconi Selenia Communications		General	Step-by-Step approach	In the implementation strategy decision it should be also taken into consideration impacts the Military and defence area. We have noticed that, after the problems they had with the 8.33 implementation, Military users are much more sensitive to what is going on in the Civil ATM world (GATM Requirements). Since the typical acquisition time in the defence field is much more longer than in the Civil one, the lack of a clear view and path toward a definitive implementation solution may lead to wrong decisions, extra costs and lack of performances when effectively needed. Later changes in the directions, and near-mid term solutions should not taken into consideration here at all. Therefore, though a step-by-step approach could be of course required, in this area, more than in the civil one, a clear and firm decision for a long-term solution is strongly required.	Noted

603	Marconi Selenia Communications		General	Voice Communications.	Even Though the actual ATM is mainly based on analog voice communications it seems to us a non sense to put constraints and limitation today on the usage of future data links just to preserve the integrity of legacy systems based on obsolete technology. Already today most of the telecommunications systems are already based on digital voice solutions. Digital voice is today a very well consolidated, sound, mature and cost effective technology. It is very difficult think about an aviation community still depending on Analog communications in the next 10-20 years. Digital voice is also the only means to improve Security and reliability of the aeronautical communications that is in the end to improve the safety of the aeronautical transportation.	Noted, added to TA discussion on complexity og point to coint datalinks
604	Marconi Selenia Communications		General	Improvement of Analog VHF radios	Should the digital-Voice co-siting be a serious issue, we should also think about ways to improve the existing legacy radios by adding modification kits internally and/or externally. A major improvement on voice radios has been just recently applied through the introduction of the 8.33 frequency spacing and of the FM immunity requirement. As mandated by ICAO, all the radios and the landing equipments have been equipped with a specific filter to reduce interferences effects of the FM broadcasting radios. Why then a similar process could not be possible also to allow the introduction of one of the greatest technology improvements in the ATM since the early commercial flights? Also very sophisticated co-siting technologies, such as dynamic filtering, that have been already developed in other fields, could be used in a cost effective manner also in the civil aviation if useful.	Noted, added to TA discussion on complexity og point to coint datalinks
605	Marconi Selenia Communications		General	Co-siting Issues.	The objections raised against the co-siting issues of VDL Mode4 seem to be totally out of the picture. This problem, due to the adopted modulation scheme (D8PSK vs. GFSK) is even worst with any other VDL than VDL4. The problem should be then re-stated and reported in a different and more balanced way. Attention should be focalised on possible solutions to mitigate this general problem and eventually to carefully identify and select the data link technology that may provide the largest set of functions and the greatest flexibility, such as VDL4.	Noted, comment in this areas have been added
606	Marconi Selenia Communications		General	Continuous transmissions:	It has been stated that VDL4 may cause more interference problems than VDL2 due to its expected continuous transmission vs the more sporadic nature of VDL2. This appears to be totally misleading specifically taking into consideration the set of functions are actually proposed on VDL2: ATC, AOC, TIS-B, FIS-B, AIS etc. In the most critical flight phases in the Terminal Area a quite large amount of data communications will be required as well causing the VDL2 transceiver be continuously in transmission.	Noted, comment in this areas have been added
607	Marconi Selenia Communications		General	Alternative service providers:	At the end of the meeting, as also directly stated by SITA and ARINC, it has been evident that one of the main reasons to adopt VDL2 is that there are already two service providers (not in competition each other) ready today to deploy the service. No other solution has been stated as available. This is not true, alternatives providing more competitive and cost effective communications services could be deployed in a 2 years time frame also using VDL4. This solution is already of interest of several airlines today, and we as a leader communication Industry can fully confirm its feasibility.	Noted, Marconi Selenia Communications support for VDL4 added to technical annex.
608	Comm4Solutions		General	The Co Siting issue.	The Co Siting problems is indeed a problem for any datalink that shall be used onboard an aircraft where DSB AM voice is to be used. The problem is also dependent on the modulation scheme of the VHF Data Link to be used. Our calculations give that the most sensitive datalink suggested in the Datalink roadmap work is VDL Mode 2 using the D8PSK modulation scheme. The more robust one is VDL Mode 4 using the GFSK modulation scheme. We therefore have two suggestions. 1. Use the more robust datalink – VDL Mode 4 – to the greatest extent possible. 2. Take great care in the frequency planning to get the largest separation between voice and VDL transmissions.	Noted, added to TA discussion on complexity og point to coint datalinks
609	Comm4Solutions		General	The issue of repetitive transmissions.	Airbus stated that VDL Mode 4 is a greater problem than VDL Mode 2 due to the nature of the transmissions. As datalink usage is expected to increase we think that this is not a valid issue. VDL Mode 2 will suffer exactly the same problems as VDL Mode 4 but (as described above) to an even larger extent.	Noted, comment to this effect added

610	Comm4Solutions		General	Multi Slot Messages.	The nature of VDL Mode 4 allows large AOC messages to be split up into a number of packages/slots and transmitted into a number of slots, not following directly upon each other. If one single slot is missed it is only required to re-send the content of that specific slot. This will even further optimize the use of frequency spectrum.	Noted, Simulation required to investigate this
611	Comm4Solutions		General	Safety Critical issues no 1.	The report does not include CPDLC as an important enabler in Terminal Area Flying. I think this is a very good conclusion as Boeing and Airbus in their operating manuals for aircraft both clearly states that below Flight Level 100 should the pilots' attention be to the very large extent be focused on flying the aircraft, and not managing the MCDU. Operational trials, for example in the PETAL II and the NEAN also demonstrate that CPDLC below 10 000 feet must be presented in another way than a printout out of the pilots' primary field of view.	Noted
612	Comm4Solutions		General	Activities in other areas of the world.	The datalink activities, both AOC and ADS-B, in the US has received a large importance in the roadmap, which they also are entitled to. The same sort of datalink activities, but based on other technologies, in Russia has been given almost no importance at all. I think this should be corrected in the report.	Noted, comments on Russian plans have been added
613	Comm4Solutions		General	Statement from our competitors.	SITA stated in their comments that there is no serious competitor to VDL Mode 2. As the CEO of Com 4 Solutions, a company offering datalink solutions via VDL Mode 4 I must object strongly to this. It is a fact that we are a newly started company. With this in mind it is of utmost importance that the European rules for competition are not infringed in any way so that a monopoly situation is maintained instead of giving the customers any benefits of new technologies.	Noted, Comm4Solutions is mentioned in our documentation.
614	CNS Solutions		Datalink Roadmap	Com.	Last AMCP meeting approved VDL Mode 4 as a possible communication data link. This will also open the possibility to use voice over VDL 4. This should be mentioned in the report	Note added to Annex on VDL4
615	CNS Solutions		Datalink Roadmap	TIS-B.	This functionality has been demonstrated through some EC sponsored programmes i.e. NEAN in Italy and NUP Phase I to be a service of importance during transition.	Noted.
616	CNS Solutions		Datalink Roadmap	Safety and time critical messages.	VDL Mode 2 will not be able to support time critical and safety related information that VDL Mode 4 can. From this perspective VDL 2 is an interim system and as such a dead horse and should not be used.	Noted, comments relating to lack of QoS of VDL2 added
617	CNS Solutions		Datalink Roadmap	AOC/ATM and ADS-B.	VDL 4 will be able to do all AOC/ATM related traffic together with ADS-B. There is no need for a VDL 2 data link that only support AOC.	Noted
618	CNS Solutions		Datalink Roadmap	Restrictions for VDL 2.	VDL 2 should not be used below FL100 according to Airbus and Boeing operating manuals.	Noted
619	CNS Solutions		Datalink Roadmap	Gate-to-gate system.	VDL 4 can be used as a gate-to-gate system that Mode S/UAT can't	Noted
620	CNS Solutions		Datalink Roadmap	Mode S/1090 ES.	It's very important to mention the difference between Mode S EHS and 1090 ES. With Mode S equipped A/C a complete new equipage has to be paid for to get 1090 ES. This will cost. Furthermore there are no tests that show that ACAS/TCAS can work together with 1090.	Several manufacturers have stated that the same transponder for Mode S EHS also supports 1090ES. Additional cost (CDTI etc) are included as appropriate.
621	CNS Solutions		Datalink Roadmap	EC sponsored programmes.	All EC sponsored VDL 4 programmes should be mentioned	Please see Annex J in Technical Assessment
622	CNS Solutions		Datalink Roadmap	Executive summary.	The October issue of executive summary better reflects the contents of the roadmap than December issue.	Noted
623	CNS Solutions		Datalink Roadmap	VDL 4 for Russia and Sweden.	Statement that both Russia and Sweden has decided to use VDL 4 for ADS-B should be mentioned.	Added
624	CNS Solutions		Datalink Roadmap	The monopoly situation.	ARINC and SITA has today a monopoly situation in today's AOC world. With "open" systems like VDL 4 a better competitive market will be at hand for benefit to all operators.	Noted
625	CNS Solutions		Datalink Roadmap	VDL 4 spectrum efficiency.	It is a basic fact (SARP's) that VDL 4 (CCI 12 dB) is many times more spectrum efficient than VDL 2 (CCI 26 dB). The amount of VDL 2 ground stations to cover Europe will lead to saturation of spectrum.	Added to discussion on complexity
626	CNS Solutions		Datalink Roadmap	Installation cost.	VDL 4 for AOC (1 Tx and 3 Rx of which one is working on ACARS) and ADS-B can be installed and replace today's ACARS equipment with no other complementary installations than updating manuals etc.	Noted
627	LFV		General Comment	FUNDAMENT FOR A EUROPEAN DATA LINK ROADMAP	First of all it is important to appreciate the extraordinary work by Helios, to compile the information on data link technologies that is now available in the report material. The material is characterised of a high level of objectivity and it should form a solid base for a European decision on data links in support of ATM functions in Europe.	Noted

628	LFV		General Comment	FUNDAMENT FOR A EUROPEAN DATA LINK ROADMAP (cont)	The interpretation of this material forming conclusions and subsequent decisions should be taken within the framework of the ICAO CNS/ATM Operational Concept that is expected to be endorsed by the 11th Air Navigation Conference in September 2003 and the European ATM 2000+ strategy providing the envisaged benefits through the modern CNS/ATM system. Globally standardised CNS components are at hand but work on the ATM functions and applications are still ongoing. In order to avoid fragmented solutions that might hamper the availability of efficient ATM solutions, the most capable CNS technologies should be selected for implementation.	Noted
629	LFV		General Comment	CNS SUPPORTED BY ONE SYSTEM	VDL Mode 4 was developed as a generic communications system supporting all the three disciplines of C(ommunication), N(avigation) and S(urveillance). The ICAO standard was originally approved for surveillance applications. At AMCP/8 in February 2003 it was decided to recommend to ICAO to make VDL Mode 4 applicable to communication applications as well. The aviation position for agenda item 1.28 at the World Radio Conference in June 2003 (WRC-2003) deals with allocation of navigation and surveillance services supported by data links in the band 108-118 MHz and it is expected that the WRC-2003 will decide in accordance with the aviation position. Subsequently there are no regulatory impediments against applying VDL Mode 4 as a data link supporting C, N and S applications.	Added
630	LFV		General Comment	CNS SUPPORTED BY ONE SYSTEM (cont)	An often raised objection against VDL Mode 4 being a generic CNS data link is that these three services should not be handled by the same system referring to integrity, redundancy and security issues. On the other hand this is fully accepted by the aviation community for satellite systems. The AMSS standard is implemented onboard Inmarsat satellites supporting communication applications (like CPDLS, AOC and voice communications), surveillance applications (like ADS-C) and GNSS augmentation (SBAS including WAAS and EGNOS). Furthermore, passenger communications is mixed with safety communications in the same system. The claimed reason is always the high costs for satellite systems. It should be argued that if the implementation, integrity, redundancy, availability and security issues could be resolved for satellite systems, it should be possible to resolve them for VHF systems as well.	Noted
631	LFV		General Comment	CNS SUPPORTED BY ONE SYSTEM (cont)	If an overall view is taken on the operational needs in the future ATM environment, it becomes obvious that there are a number of good reasons supporting the idea of letting one system support all CNS disciplines, like resolving co-site issues, security aspects, data link management, reduction in costs for equipment and logistics.	Added
632	LFV		General Comment	CO-SITE ISSUE	The radio wave propagation characteristics of VHF are extremely useful in aviation, which is one reason for the VHF band being so congested. Several systems operating in this band have been developed by aviation. They operate independently of each other causing situation of interference that cannot be avoided by frequency planning methods i.e. using frequencies that are separated in the spectrum. The traditional DSB-AM analogue voice system is the most vulnerable of the VHF systems. This co-site problem has incorrect been made to a VDL Mode 4 problem in the resent debate, but it is equally applicable to all VHF systems operating onboard an aircraft.	Noted, comments added

633	LFV		General Comment	CO-SITE ISSUE (cont)	ICAO identified the co-site problem during the standardisation of VDL Mode 2 as in implementation issue to be resolved by industry. An Ad Hoc Working Group of the Data link Subcommittee of the Airlines Engineering Committee (AEEC) addressed the issue and reported their findings to ICAO. AEEC concluded that interference from VDL in to the DSB-AM receiver were not worse than those due to interference from Aircraft Communications Addressing and Reporting System (ACARS) that has been in operation onboard aircraft for many years. It was noted that these implementations included both adaptive S/N squelch and dynamic RF attenuation. Without these techniques it was highly probable that performance of closely spaced DSB-AM with on-board VDL or ACARS would not be acceptable. (Reference the ICAO Aeronautical Mobile Communications Panel (AMCP) Seventh Meeting Report on Agenda Item 4 and AEEC Letters 99-140/DLK-861 and 00-002/DLK-871.)	Added
634	LFV		General Comment	CO-SITE ISSUE (cont)	It should be observed that VDL Mode 4 prototype equipment has been tested onboard various types of aircraft without any major co-site problem being identified. However, it should be noted that not all VHF frequencies have been tested and unwanted harmonics might occur in limited parts of the VHF spectrum. Partially "muting" DSB-AM receivers during data link transmissions seems to be operationally acceptable. This possibility should be further studied in order investigate a) the full impact on DSB-AM operations; and b) the level and length of muting required taking into account the length of data link transmission and the impact of ramp-up and ramp-down of the digital radios. If muting would be required only during ramp-up, it would probably not affect the DSB-AM system at all.	Added
635	LFV		General Comment	CO-SITE ISSUE (cont)	Another co-site issue is the interference between VDLs. If more than one VDL is operating onboard an aircraft simultaneously, all receptions would be blocked during transmissions of one VDL system as well as simultaneous transmissions would interfere with each other. The solution to this problem is to avoid simultaneous VDL activities by having an external "managing function" or only allow one VDL system onboard aircraft. The VDL Mode 4 standard is requiring that all transmissions on VDL Mode 4 frequencies being coordinated in order to avoid unintentional interference.	Added
636	LFV		General Comment	SECURITY AND SAFETY ISSUES	Since the 11th September event, aviation is specially focusing on security and safety issues, that involve ensuring confidentiality, authentication, integrity and availability of the communications service. The ATN addresses data-link security at the upper layers of the OSI stack and includes mechanisms for authentication and integrity of air-ground applications and IDRP communications as well as support for cryptology based on a Public Key Infrastructure (PKI). The currently defined data links do not however support security measures at the lower level. Best practice from military data-links suggests that improvements to safety and security can be achieved by including relevant mechanisms within the lower layers. In particular, knowledge of an aircraft's position, which is available within the VDL Mode 4 system, is of particular advantage in developing authentication functions, which would support all applications (ADS-C, ADS-B, CPDLC, conflict resolution etc).	Added to Annex J in TA
637	LFV		General Comment	SECURITY AND SAFETY ISSUES (cont)	The concept of ADS-B includes automatic transmission of intent and trajectory information, allowing receiving units to know about the actual intention of aircraft at an early stage. This function is supporting efficient and orderly flow management but it would also provide early warning and alarm in situations of unlawful activities.	Added to Annex J in TA
638	LFV		General Comment	SECURITY AND SAFETY ISSUES (cont)	An essential part of The VDL Mode 4 system is the independent timing function based on the possibility of range measurements, i.e. measuring how long time it takes for a message to travel from the transmitter to the receiver. As the transmission speed is equal to speed of light, the time can easily be transferred to distance to the transmitter making it possible to verify that position information in synchronisation bursts (used for data link management and ADS-B in VDL Mode 4) is correct, thus avoiding the risk for spoofing transmitters.	Added to Annex J in TA

639	LFV		General Comment	SECONDARY NAVIGATION	The ranging function can also be used as a complement and backup to GNSS. In the VDL All ground stations in the Mode 4 concept regularly transmits their position and accurate time together with an indication announcing if the particular ground station is certified for "secondary navigation". Providing that "secondary navigation" is supported, all mobiles can use transmissions from these ground stations and calculate their actual position. This could form an extra safety net independent of GNSS and traditional ground based means for navigation.	Added to Annex J in TA
640	LFV		General Comment	DATA LINK MANAGEMENT	Position information included in the VDL Mode 4 synchronisation bursts can also be used to optimise data-link management functions in a very efficient way, which would be applicable to all data link functions independent of it is used for surveillance or communication applications.	Added to Annex J in TA
641	LFV		General Comment	DATA LINK FOR COMMUNICATIONS	The development of communication function in aviation is flavoured by the dominating position of ARINC and SITA providing AOC services for airlines. ARINC and SITA were the drivers behind development of the VDL Mode 2 standard and it could be claimed that VDL Mode 2 was developed as a replacement of ACARS (only used for AOC).	Noted
642	LFV		General Comment	DATA LINK FOR COMMUNICATIONS (cont)	It is clearly stated in the European COM Strategy that VDL Mode 2 is not supporting time critical communications and applications requiring a deterministic behaviour. The strategy identifies that another link should be available around 2007 in support of ATM applications and it identifies VDL Mode 3 or VDL Mode 4 as the candidates. According to a commonly accepted opinion in Eurocontrol, it is not possible to implement VDL Mode 3 in Europe due to frequency constraints. Furthermore, according to US FAA plans the data link function of VDL Mode 3 would be available around 2012 and it should be noted that ARINC and SITA is not foreseeing full deployment of VDL Mode 2 until around 2012. If Eurocontrol intends to support the envisaged advanced ATM functions and the European Communications strategy, the Link 2000+ Programme should focus on VDL Mode 4 implementations in order to have communication services based on VDL Mode 4 available in 2007.	Noted
643	LFV		General Comment	DATA LINK FOR COMMUNICATIONS (cont)	The strong support for VDL Mode 2 and the obvious reluctance to accept VDL Mode 4 could be perceived as a preservation of a monopoly favouring ARINC and SITA as communication service providers in aviation. The Com4Solution consortium is offering similar services over VDL Mode 4 and one of their potential major costumers is EasyJet. Experience from the process of requesting frequencies for VDL Mode 4 communication services is indicating that the frequency management functions is giving VDL Mode 2 (i.e. ARINC and SITA) higher priority than VDL Mode 4 is obtaining. This is not consistent with the ideas of an open market characterised of free competition within a unified Europe...	Noted
644	LFV		General Comment	INTEROPERABILITY	The issue of interoperability is often raised when discussing data links. It should be noted that aviation has created the Aeronautical Telecommunications Network (ATN) with the understanding that all communications should be provided through ATN. The concept consists sub-networks on ground and in the air and a fundamental principle is that various networks should be interconnected within ATN creating a transparent communication cloud for aviation. Subsequently ATM can handle multiple sub-networks and Quality of Services (QoS) parameters are defined for applications allowing ATN to select the most appropriate sub-network for a particular information exchange. ATN is built upon principles of OSI, but provisions are being made for allowing TCP/IP to be used. VDL Mode 4 is designed to be an ATN sub-network as well as a mobile link within a TCP/IP based network. Claiming that if VDL Mode 4 is allowed to support communication applications, it would create an interoperability problem is equal to claim that ATN will never be implemented.	Noted
645	LFV		General Comment	INTEROPERABILITY (cont)	The Eurocontrol Link 2000+ programme is claiming that ATN is being implemented, but so far commitments among service providers and airlines only seems to include support for VDL Mode 2/AOA, i.e. ACARS over a VDL Mode 2 physical layer.	Noted

646	LFV		General Comment	INTEROPERABILITY (cont)	The interoperability issue with respect to point-to-point data links could be considered as a non-issue, as no data exchange will take place unless systems at both ends acknowledge this through agreed protocols, i.e. there will be no risk for "misinterpretations".	Agreed
647	LFV		General Comment	INTEROPERABILITY (cont)	For broadcast services, the interoperability issue is more fundamental as no pre data transfer processes exist in order to agree on what system/protocol to be used. One solution might be to require aircraft to be equipped with multiple systems. Another would be to use retransmissions of information received from system not supported in a specific region. TIS-B has been developed in support of the latter alternative and as a possible mean for supporting transition from traditional radar based surveillance services to ADS-B based. However, the operational usefulness of TIS-B is not fully explored yet.	This sentiment is included in the TA report
648	LFV		General Comment	DATA LINK FOR ADS-B	Eurocontrol is cooperating with the US FAA in order to define a consistent ADS-B solution that would be globally applicable. The process has resulted in a US data link decision identifying Mode S Extended Squitter (1090) as the ADS-B system for air transport and the UAT system as the ADS-B system for General Aviation. It should be noted that the view of the role of ADS-B differs between US and Europe. ADS-B has never been considered for ground-based surveillance in the US, even if there are signs (e.g. work on Package 1 applications) indicating that this might change.	Noted
649	LFV		General Comment	DATA LINK FOR ADS-B (cont)	In a way it could be claimed that, the US decision is limiting the options for a European position but it seems difficult for Europe to find consensus for such a decision. The draft European position includes Mode S Extended Squitter (1090) as the initial ADS-B system and it identifies that a second system would be needed and this might be VDL Mode 4. The driver behind the draft position is probably that some of the core European states have decided to implement Mode S Enhanced Surveillance and it is believed that ADS-B will be included for "free".	Noted
650	LFV		General Comment	DATA LINK FOR ADS-B (cont)	It should be noted that ICAO developed the standard for Mode S Extended Squitter as an enhancement to ACAS (called TCAS by the US) in order to make the "collision avoidance system" more precise.	Noted
651	LFV		General Comment	DATA LINK FOR ADS-B (cont)	During the process of developing the ICAO provisions for VDL Mode 4 as an ADS-B system, it was commonly understood that Mode S Extended Squitter should address short range applications requiring rapid updates (like ACAS) and that VDL Mode 4 should support long range applications. Furthermore, having two different systems based on different technologies and systems operating in different frequency bands supporting "collision avoidance" like applications and ADS-B based surveillance functions were considered being sound by ICAO.	Noted
652	LFV		General Comment	DATA LINK FOR ADS-B (cont)	The Mode S Extended Squitter system evolved to a more ADS-B like system through the process in RTCA and was called 1090, but it is still hampered by the initial design characteristics and the very congested spectrum. This means that same part of the spectrum and similar systems should support both traditional ground based surveillance services (by radar), collision avoidance functions (by ACAS/TCAS) and ADS-B (by Extended Squitter 1090). This is especially alarming considering that ACAS/TCAS is the last safety net that should be in operation when all other precautions have failed.	Noted
653	LFV		General Comment	DATA LINK FOR ADS-B (cont)	All analysis and evaluations shows that Mode S Extended Squitter (1090) is the least capable ADS-B system of the available alternatives. It is also uncertain if any Mode S Extended Squitter ground stations has been standardised or is available.	Noted
654	LFV		General Comment	DATA LINK FOR ADS-B (cont)	A European decision on an ADS-B system should not initially focus on the core area of Europe, as the present infrastructure is capable of supporting the operational needs for the near future. The situation is different in the peripheral areas of Europe where the surveillance infrastructure is poorly developed or non existing. It also includes consideration of the neighbouring countries (like Russia and northern Africa) that is having an opportunity to leap one generation of technology. An European decision should be driven by early benefits.	Noted

655	LFV		General Comment	POSSIBLE SOLUTION FOR EUROPE	The data link roadmap will look different depending if it is based on technical and operational findings or if it based on other aspects. The time frame considered also affects the data link road map. One solution might be to define a basic long-term roadmap based on technical and operational facts, allowing those who want to apply a sound long-term view to do so. A parallel roadmap could be defined based on short-term goals and politics allowing those who prefer to neglect the obvious facts to do so. This might not be the most efficient approach, but it would foster a sound competing environment providing that all alternatives would be given equal grounds with respect to possibilities, i.e. are being dealt with equally when assigning limited resources like spectrum.	Noted. The roadmap include two routes one based on 1090 ES and VDL2 for those with previous investment, and one based on VDL4 for other users such as GA and the Low Cost airlines who wish to take advantage of new technology
656	LFV		General Comment	POSSIBLE SOLUTION FOR EUROPE (cont)	Regarding the data link for ADS-B, Europe should note the US decision and state that as some of the core European states have decided to implement Mode S Enhanced Surveillance the ACAS/TCAS functionality will be improved. Then Europe should either state that VDL Mode 4 has been selected as the ADS-B system for Europe or that Europe is focusing its resources on VDL Mode 4 as the most likely ADS-B system for Europe.	Noted
657	INFOSYS		General Comment	General Comments	INFOSYS is pleased to comment the study you and your team presented at DG TREN in Bruxelles on 21 February 2003. Our comments at the same time are reflections on some of the discussion points at this event. We are convinced that the study is a adequate and solid basis for the long overdue and urgently needed decision for a European data-link technical concept and a concept of operations for the air transport community under the Single Sky Programme. We strongly support the comment of the Swedish CAA, that the 30 October versions of the Road Map and the Draft Executive Summary should be used as the basis for producing the final documents. The December versions contain misleading comments and unsubstantiated opinions that do neither reflect the contents of the document itself nor the study's findings. They might thus mislead readers who do not know the whole document to draw false conclusions.	Noted
658	INFOSYS		General Comment	General Comments	At the presentation it was obvious that the overwhelming majority of the stakeholders and especially the speakers for AEA and GA fully supported the findings of the study, namely that VDL Mode 4 is the best choice to fulfil the operational requirements of the airspace users. Contrary to the opinion voiced by Eurocontrol, these requirements were already clearly defined and co-ordinated with the representatives of the major European aircraft owners' and operators' associations in the DG TREN ATLAS 2A study. Only a small but very outspoken group did not support the results of the study. The opposing group made no attempts to conceal that their rational and motives were clearly non-operational but commercially driven. It was also noteworthy that contrary to many of their PR statements in which the national CAAs go out of their way proclaiming their "customer orientation", the representatives of the service providers indicated that data-link for them is a rather insignificant technical feature. All the new applications enabled by data-link and urgently demanded	Noted
659	INFOSYS		General Comment	New Technical Concept visible	A crystal clear technical concept is now visible: This will see VDL Mode 4 implemented in two roles: Primarily for ADS-B (including the cockpit display of traffic information, CDTI, which in itself will tremendously improve flight safety for all) and secondarily in the role of communications supporting applications like TIS-B, FIS-B, CPDLC, GRAS, AOC, etc. This concept clearly reduces the complexity of systems on board and on the ground. It avoids interface problems otherwise caused by a mixture of VHF gear on board. It also provides the best spectrum efficiency, most simplified logistics, common ground networks, common development of applications and low cost for airlines and GA. This technical concept in its clear and homogeneous structure leads logically to a very straight forward concept of operations. The air traffic service providers (ATSP) could benefit from a new source of income by charging the airspace users for AOC services, unless they decide to leave this market to ARINC and SITA. These commercial communications providers will of course use Mode 4 once a	Noted

660	INFOSYS		General Comment	Exploitation of the VHF Spectrum	The VHF aviation spectrum is an extremely rare asset which cannot be extended or "stretched". Alternatives proposed e.g. wide band solutions in higher frequency bands or based on satellite links will require much higher power output and direct line of sight operations. This will make them less suitable for GA. There is really no better band available than the one we use. That means that its exploitation must not follow a simplistic "rule" like "Who comes first gets served first!" Management of any scarce resource requires to define clear priorities and enforcing them against individual interests. AOC in this context is a clear "NICE TO HAVE" competitor compared to safety-linked ATC/ATM functions and applications. But the above mentioned technical concept has an even better solution available also for AOC. So, one of the most interesting results of the study is that AOC does not depend on the implementation of VDL Mode2 but would be technically better supported by Mode 4. In view of the past struggles the European experts went through trying to manage the approval of Mode 4 in ICAO might lead to the conclusion th	Noted
661	INFOSYS		General Comment	Decisions for the future European CNS/ATM Infrastructure	The European ATC/ATM infrastructure is a perfect example of how individual eagerness and enormous efforts to develop the best possible local systems lead to an sub-optimal overall system. The sum of the development and procurement costs would have easily sufficed to implement several generations of CNS/ATM infrastructure including the related aircraft equipage, had these efforts only been planned and managed in harmony. Today Europe stands again at a decision point. We may not be able to convince the whole world at once, but we can make a large step towards a global solution. All we have to do is to look beyond the bickering interest groups and decide to do what is technically sound, cost efficient and great for air safety.	Noted
662	Easy Jet		General Comment	Bottom Up or Top Down?	We cannot make the necessary change in a timely fashion based on 'bottom-up' incremental changes. The existing systems have delivered us to where we are now. In trouble. System operating at or near acceptable limits. Unbelievable complexity. Extreme Cost. 10 year+ timelines for core system capacity capability.	Noted
663	Easy Jet		General Comment	Datalink is common thread in numerous key projects	The Report MUST be actively linked with these projects; some I can list i.e. not exhaustive are: MA-AFAS/ASAS (FP5/6 projects); FLYSAFE (On-aircraft Safety Integrator system; FP6 project); Mediterranean Free Flight (MFF); NUP II. Overall, getting the best datalink based on available technology will create synergistic benefits that are likely to deliver a step change in many areas	Noted
664	Easy Jet		General Comment	We need to see the similarities	Overall, many activities need a 'small' package of dynamic data. VDL4/ADS-B and applications can deliver this data. So why are we continuing to define 'silo' systems. "Plan for the rule; manage the exception"... If there is a data-use system in operation or proposed that cannot be operated with data from an enabler such as VDL4 then let's identify it. This is then is the exception; manage it as such.	Noted
665	Easy Jet		General Comment	VDL4 is a universal enabler	It could replace, radar, Mode S, 1090 and more. To mandate Mode S in 3 core states required ALL aircraft to equip i.e. a 100% solution for a 73-4% problem; these states should be forced to implement a generic method rather than discrete. The costings in the report should stack VDL4 versus 'the rest' i.e. 1090, Mode S etc to get a true cost benefits. We will NEVER get the intended benefits of CDM if we don't connect all actors with a modern high speed system.	Noted
666	Easy Jet		General Comment	Safety encompasses all airspace users	Unless we embrace all aircraft i.e. include the majority that are not air transport category, we are NEVER going to get a step change in safety. NEVER.	Noted
667	Easy Jet		General Comment	Old technology should not be the benchmark	We cannot seriously move forward if we cannot admit that the retention of certain existing technology is a significant impediment to goal achievement. In particular, analogue voice radios should be actively replaced with digital. The issue of CCI and spectrum wastage would be largely resolved	Noted
668	Easy Jet		General Comment	A High Principle	The Future ATM system will have as it's basis of operation, the dynamic data defining the exact position and trajectory of all aircraft, from the aircraft itself. i.e. systems requiring the complex algorithms and attendant computing capacity to 'guess' the intent of an aircraft will not be required. Amongst many benefits is both lower cost of manufacture and much shortened lead-time for new system delivery	Noted

669	Easy Jet		General Comment	Dynamic Safety Management System	An inherent requirement of the future ATS System is the ability to collect (and allow later independent supplementary information), safety data into a shared system. This systems and its 'real-time' outputs should be a natural part of the ATS system e.g. be visible to a controller, airline or airport to assist the safe delivery of their role. A proper datalink can significantly contribute to this delivery.	Noted
670	Easy Jet		General Comment	Technical Facts	The Report must be distilled to deliver these 'only'.	Noted
671	Easy Jet		General Comment	Non-Starter Technologies	'Eliminate' all realistically unavailable technologies from the main body of the report then discuss very clearly those that can, list and prioritise items that need further investigation and actively resolve. Completing of all this within six months with one month progress reports.	Noted
672	Easy Jet		General Comment	10 Effectively Use Community Funds	Find means to direct the funds in the EU to delivering solutions that will ensure that the EU's fundamental responsibilities are also delivered. Vision a system that TRULY has capacity to deliver growth with REAL safety margins (i.e. if we continue to operate over the next 5-10-15 years on the margins of capacity then axiomatically we are also condoning operation on the margins of safety.) The system participants who are seriously committing to a better future e.g. manufacturers, airlines, ANSP's, airports now, MUST be actively helped to lead the change by example and deliver operating proof of all the great European R & D effort that has and is been delivered. We have a body of knowledge that is second to none. Now is the time to leverage this to our mutual benefit	Noted