

Navico Map Creator / Insight Map Creator Project File Format

Herbert Oppmann

herby@memotech.franken.de

<http://www.memotech.franken.de/FileFormats/>

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Navico Map Creator / Insight Map Creator Project File Format

Filename extension *.sap

This documentation is based on own research and the sources listed in the references section.

Basic data types

All values are serialized in little-endian byte order (least significant byte first).

Type	Length	Description
char	1	Windows 1252 character
byte	1	8 bit unsigned integer (range 0 .. 255)
ushort	2	16 bit unsigned integer (range 0 .. 65535)
uint	4	32 bit unsigned integer (range 0 .. 4294967295)
float	4	32 bit floating point value according to [2].
double	8	64 bit floating point value according to [2].

Navico Map Creator Format

Type	Content
uint	Signature = 0x4153774C "LwSA" probably stands for „Lowrance SA“ (whatever „SA“ stands for – at least „sap“ stands for „SA“ project file)
uint	Format version = 3
byte	Processing mode 0: Vector mode 1: Raster mode 2: Keyhole mode 3: Sonar mode
uint	Number of source shape files
Number of source shape files times:	
MCString	File name
uint	Number of source folders
Number of source shape folders times:	
MCString	Folder name
float	Min resolution
float	Max resolution
MCString	Work directory
MCString	Raster filter shapefile
uint	Number of source folders
Number of source folders:	
MCString	Source folder
byte	Auto create XML 0: false 1: true
byte	Restricted use 0: false 1: true
byte	Restricted use (store) 0: false 1: true
byte	Atlas version 0: Version 12 1: Version 10
byte	Project based naming 0: false 1: true

byte	Map wrapper 0: false 1: true
byte	Mercator Lowrance 0: false 1: true
byte	Filter image boundary 0: false 1: true

MCString

Type	Content
byte	string length (in byte), may be 0
char	Characters of the string. There is no string terminator at the end. The string consists of chars according to the Windows 1252 character set.

Insight Map Creator V0.6.5.x format

Uses Google Protocol Buffers, see [1] and [3].

Header
List of Fields, in ascending order, without gaps

Header

Type	Content
uint	Signature = 0x66425047 "GPBf" stands for „Google Protocol Buffers“
Varint	Length after header

Field Processing mode

Type	Content
Varint	Key = 0x08 → Field number = 1, Wire type = 0 (Varint)
Varint	Processing mode 0: Vector mode 1: Raster mode 2: Keyhole mode 3: Sonar mode

Field Source shapefiles

Type	Content
Varint	Key = 0x12 → Field number = 2, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	Varint String length
	n x char Source shapefile name

Field Source folders

Type	Content
Varint	Key = 0x1A → Field number = 3, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
until end of field:	
	Varint String length
	n x char Source folder name

Field Keyhole files

Type	Content
Varint	Key = 0x22 → Field number = 4, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
until end of field:	
Varint	String length
n x char	Keyhole file name

Field Min resolution

Type	Content
Varint	Key = 0x2D → Field number = 5, Wire type = 5 (32-bit)
float	Min resolution in big endian (this is a bug!)

Field Max resolution

Type	Content
Varint	Key = 0x35 → Field number = 6, Wire type = 5 (32-bit)
float	Max resolution in big endian (this is a bug!)

Field Work directory

Type	Content
Varint	Key = 0x3A → Field number = 7, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
n x char	Work directory

Field Raster filter shapefile

Type	Content
Varint	Key = 0x42 → Field number = 8, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
n x char	Raster filter shapefile

Field Acknowledgements

Type	Content
VarInt	Key = 0x4A → Field number = 9, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
until end of field:	
Varint	String length
n x char	Acknowledgement

Field Auto create XML

Type	Content
VarInt	Key = 0x50 → Field number = 10, Wire type = 0 (Varint)
VarInt	Auto create XML 0: false 1: true

Field Restricted use

Type	Content
VarInt	Key = 0x58 → Field number = 11, Wire type = 0 (Varint)
VarInt	Restricted use 0: false 1: true

Field Restricted use (store)

Type	Content
VarInt	Key = 0x60 → Field number = 12, Wire type = 0 (Varint)
VarInt	Restricted use (store) 0: false 1: true

Field Atlas version

Type	Content
VarInt	Key = 0x68 → Field number = 13, Wire type = 0 (Varint)
VarInt	Atlas version (6, 7, 10, or 12)

Field Project based naming

Type	Content
VarInt	Key = 0x70 → Field number = 14, Wire type = 0 (Varint)
VarInt	Project based naming 0: false 1: true

Field Map wrapper

Type	Content
VarInt	Key = 0x78 → Field number = 15, Wire type = 0 (Varint)
VarInt	Map wrapper 0: false 1: true

Field Mercator Lowrance

Type	Content
VarInt	Key = 0x80 → Field number = 16, Wire type = 0 (Varint)
VarInt	Mercator Lowrance 0: false 1: true

Field Filter image boundary

Type	Content
VarInt	Key = 0x88 → Field number = 17, Wire type = 0 (Varint)
VarInt	Filter image boundary 0: false 1: true

Field Cache

Type	Content
VarInt	Key = 0x90 → Field number = 18, Wire type = 0 (Varint)
VarInt	Cache 0: Decache unused 1: Cache 10M points 2: Cache 50M points 3: Cache 100M points 4: Cache 200M points 5: Cache 500M points 6: Unlimited cache

Field Imagery

Type	Content
VarInt	Key = 0x98 → Field number = 19, Wire type = 0 (Varint)
VarInt	Imagery 3: Shaded relief imagery 4: Topographic imagery 5: Satellite imagery 6: Raster nautical chart

Field Description

Type	Content
VarInt	Key = 0xA2 → Field number = 20, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
n x char	Description

Field Skip OSM oceans

Type	Content
VarInt	Key = 0xA8 → Field number = 21, Wire type = 0 (Varint)
VarInt	Skip OSM oceans 0: false 1: true

Field Sonar files

Type	Content
VarInt	Key = 0xB2 → Field number = 22, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
until end of field:	
Varint	String length
n x char	Sonar file name

Field Sonar output file

Type	Content
VarInt	Key = 0xBA → Field number = 23, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
n x char	Sonar output file name

Insight Map Creator V0.7.4.x format

Uses Google Protocol Buffers, see [1] and [3].

Header
List of Fields, in ascending order, without gaps

Header

Type	Content
uint	Signature = 0x32425047 "GPB2" stands for „Google Protocol Buffers“
Varint	Length after header

Field Processing mode

Type	Content
Varint	Key = 0x08 → Field number = 1, Wire type = 0 (Varint)
Varint	Processing mode 0: Vector mode 1: Raster mode 2: Keyhole mode 3: Sonar mode 4: Attribute mode

Field Vector mode

Type	Content
Varint	Key = 0x12 → Field number = 2, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Source shapefile

Type	Content
Varint	Key = 0x0A → Subfield number = 1, Wire type = 2 (Length-delimited)
Varint	Length of subfield in bytes
until end of subfield:	
Varint	String length
n x char	Source shapefile name

Subfield Work directory

Type	Content
Varint	Key = 0x12 → Subfield number = 2, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Work directory

Field Raster mode

Type	Content
Varint	Key = 0x1A → Field number = 3, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Source folder

Type	Content
Varint	Key = 0x0A → Subfield number = 1, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Source folder

Subfield Work directory

Type	Content
Varint	Key = 0x12 → Subfield number = 2, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Work directory

Subfield Min resolution

Type	Content
Varint	Key = 0x1D → Field number = 3, Wire type = 5 (32-bit)
float	Min resolution

Subfield Max resolution

Type	Content
Varint	Key = 0x25 → Field number = 4, Wire type = 5 (32-bit)
float	Max resolution

Field Keyhole mode

Type	Content
Varint	Key = 0x22 → Field number = 4, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Keyhole file

Type	Content
Varint	Key = 0x0A → Subfield number = 1, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Keyhole file

Field Sonar mode

Type	Content
Varint	Key = 0x2A → Field number = 5, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Sonar file

Type	Content
Varint	Key = 0x0A → Subfield number = 1, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Sonar file

Subfield Sonar output file

Type	Content
Varint	Key = 0x12 → Subfield number = 2, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Sonar output file

Field Attribute mode

Type	Content
Varint	Key = 0x32 → Field number = 6, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Conversion rule

Type	Content
Varint	Key = 0x0A → Subfield number = 1, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
until end of subfield:	
	List of Subsubfields, in ascending order, without gaps

Subsubfield Destination field

Type	Content
Varint	Key = 0x0A → Subsubfield number = 1, Wire type = 2 (Length-delimited)
Varint	Length of subsubfield in byte
n x char	Destination field

Subsubfield Source type

Type	Content
Varint	Key = 0x12 → Subsubfield number = 2, Wire type = 2 (Length-delimited)
Varint	Length of subsubfield in byte
n x char	Source type „RESET“, „VALUE“, „NUMBER“ or „STRING“

Subsubfield Source value

Type	Content
Varint	Key = 0x1A → Subsubfield number = 3, Wire type = 2 (Length-delimited)
Varint	Length of subsubfield in byte
n x char	Source value This value is only interpreted when Source type is „VALUE“, but it may be non-empty on other Source types.

Subsubfield Source field

Type	Content
Varint	Key = 0x22 → Subsubfield number = 4, Wire type = 2 (Length-delimited)
Varint	Length of subsubfield in byte
n x char	Source field This field is only interpreted when Source type is „NUMBER“ or „STRING“, but it may be non-empty on other Source types.

Subfield Input

Type	Content
Varint	Key = 0x12 → Subfield number = 2, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Input

Subfield Output

Type	Content
Varint	Key = 0x1A → Subfield number = 3, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Output

Field Atlas options

Type	Content
Varint	Key = 0x3A → Field number = 7, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Atlas version

Type	Content
Varint	Key = 0x08 → Subfield number = 1, Wire type = 0 (Varint)
Varint	Atlas version (6, 7, 10, 12 or 13)

Subfield Restricted use

Type	Content
Varint	Key = 0x10 → Subfield number = 2, Wire type = 0 (Varint)
Varint	0: Unencrypted 1: Encrypted card 2: Encrypted store

Subfield Description

Type	Content
Varint	Key = 0x1A → Subfield number = 3, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Description

Subfield Project based naming

Type	Content
Varint	Key = 0x20 → Subfield number = 4, Wire type = 0 (Varint)
Varint	Project based naming 0: false 1: true

Subfield Map wrapper

Type	Content
Varint	Key = 0x28 → Subfield number = 5, Wire type = 0 (Varint)
Varint	Map wrapper 0: false 1: true

Field Vector options

Type	Content
Varint	Key = 0x42 → Field number = 8, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Auto create XML

Type	Content
Varint	Key = 0x08 → Subfield number = 1, Wire type = 0 (Varint)

Varint	Auto create XML 0: false 1: true
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Subfield Skip OSM oceans

Type	Content
Varint	Key = 0x10 → Subfield number = 2, Wire type = 0 (Varint)
Varint	Skip OSM oceans 0: false 1: true

Subfield Mercator Lowrance

Type	Content
Varint	Key = 0x18 → Subfield number = 3, Wire type = 0 (Varint)
Varint	Mercator Lowrance 0: false 1: true

Subfield DOR point

Type	Content
Varint	Key = 0x20 → Subfield number = 4, Wire type = 0 (Varint)
Varint (ZigZag)	DOR point

Subfield DOR line

Type	Content
Varint	Key = 0x28 → Subfield number = 5, Wire type = 0 (Varint)
Varint (ZigZag)	DOR line

Subfield DOR area

Type	Content
Varint	Key = 0x30 → Subfield number = 6, Wire type = 0 (Varint)
Varint (ZigZag)	DOR area

Subfield Group geometry

Type	Content
Varint	Key = 0x38 → Subfield number = 7, Wire type = 0 (Varint)
Varint	Group geometry 0: false 1: true

Field Raster options

Type	Content
Varint	Key = 0x4A → Field number = 9, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Raster filter shapefile

Type	Content
Varint	Key = 0x12 → Subfield number = 2, Wire type = 2 (Length-delimited)
Varint	Length of subfield in byte
n x char	Raster filter shapefile

Subfield Cache

Type	Content
Varint	Key = 0x18 → Subfield number = 3, Wire type = 0 (Varint)
Varint	0: Decache unused 1: Cache 10M points 2: Cache 50M points 3: Cache 100M points 4: Cache 200M points 5: Cache 500M points 6: Unlimited cache

Subfield Imagery

Type	Content
Varint	Key = 0x20 → Subfield number = 4, Wire type = 0 (Varint)
Varint	3: Shaded relief 4: Topographic 5: Satellite 6: Raster nautical

Subfield Mercator Lowrance

Type	Content
Varint	Key = 0x28 → Subfield number = 5, Wire type = 0 (Varint)
Varint	Mercator Lowrance 0: false 1: true

Subfield Filter alpha

Type	Content
Varint	Key = 0x30 → Subfield number = 6, Wire type = 0 (Varint)
Varint	Filter alpha 0..255

Field Sonar options

Type	Content
Varint	Key = 0x52 → Field number = 10, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Output meters

Type	Content
Varint	Key = 0x08 → Subfield number = 1, Wire type = 0 (Varint)
Varint	Output meters 0: false 1: true

Subfield Output POINTZ features

Type	Content
Varint	Key = 0x10 → Subfield number = 2, Wire type = 0 (Varint)
Varint	Output POINTZ features 0: false 1: true

Subfield Filter

Type	Content
Varint	Key = 0x18 → Subfield number = 3, Wire type = 0 (Varint)
Varint	Filter 0: interpolated/estimated 1: estimated 2: none

Subfield Filter quality

Type	Content
Varint	Key = 0x20 → Subfield number = 4, Wire type = 0 (Varint)
Varint	Filter quality

Subfield ??

Type	Content
Varint	Key = 0x29 → Subfield number = 5, Wire type = 1 (Fixed64)
Double	= 0.0

Subfield Mercator Lowrance

Type	Content
Varint	Key = 0x30 → Subfield number = 6, Wire type = 0 (Varint)
Varint	Mercator Lowrance 0: false 1: true

Subfield Invert depths

Type	Content
Varint	Key = 0x38 → Subfield number = 7, Wire type = 0 (Varint)
Varint	Invert depths 0: false 1: true

Field Acknowledgement

Type	Content
Varint	Key = 0x5A → Field number = 11, Wire type = 2 (Length-delimited)
Varint	Length of field in byte
n x char	Acknowledgement

Field Attribute options

Type	Content
Varint	Key = 0x62 → Field number = 12, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield Mercator Lowrance

Type	Content
Varint	Key = 0x08 → Subfield number = 1, Wire type = 0 (Varint)
Varint	Mercator Lowrance 0: false 1: true

Subfield Buffer

Type	Content
Varint	Key = 0x11 → Subfield number = 2, Wire type = 1 (Fixed64)
Double	Buffer

Subfield Declutter grouping

Type	Content
Varint	Key = 0x18 → Subfield number = 3, Wire type = 0 (Varint)
Varint	Declutter grouping 0: false 1: true

Subfield Gnrlz

Type	Content
Varint	Key = 0x21 → Subfield number = 4, Wire type = 1 (Fixed64)
Double	Gnrlz

Field Extent options

Type	Content
Varint	Key = 0x6A → Field number = 13, Wire type = 2 (Length-delimited)
Varint	Length of field in bytes
until end of field:	
	List of Subfields, in ascending order, without gaps

Subfield South

Type	Content
Varint	Key = 0x09 → Subfield number = 1, Wire type = 1 (Fixed64)
Double	South

Subfield North

Type	Content
Varint	Key = 0x11 → Subfield number = 2, Wire type = 1 (Fixed64)
Double	North

Subfield West

Type	Content
Varint	Key = 0x19 → Subfield number = 3, Wire type = 1 (Fixed64)
Double	West

Subfield East

Type	Content
Varint	Key = 0x21 → Subfield number = 4, Wire type = 1 (Fixed64)
Double	East

Varint (ZigZag)

A signed integer, ZigZag-encoded in a Varint.

Bit 0 is the sign.

Bit 1-63 are Bit 0-62 of the value.

Varint

An unsigned integer in a variable-sized encoding, see [3].

Using 1 byte (containing 7 bit):

	7	6	5	4	3	2	1	0
0	= 0	6	5	4	3	2	1	0

Using 2 bytes (containing 14 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0

	7	6	5	4	3	2	1	0
1	= 0	13	12	11	10	9	8	7

Using 3 bytes (containing 21 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0

	7	6	5	4	3	2	1	0
1	= 1	13	12	11	10	9	8	7

	7	6	5	4	3	2	1	0
2	= 0	20	19	18	17	16	15	14

Using 4 bytes (containing 28 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0

	7	6	5	4	3	2	1	0
1	= 1	13	12	11	10	9	8	7

	7	6	5	4	3	2	1	0
2	= 1	20	19	18	17	16	15	14

	7	6	5	4	3	2	1	0
3	= 0	27	26	25	24	23	22	21

Using 5 bytes (containing 35 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0

	7	6	5	4	3	2	1	0
1	= 1	13	12	11	10	9	8	7

	7	6	5	4	3	2	1	0
2	= 1	20	19	18	17	16	15	14

	7	6	5	4	3	2	1	0
3	= 1	27	26	25	24	23	22	21

	7	6	5	4	3	2	1	0
4	= 0	34	33	32	31	30	29	28

Using 6 bytes (containing 42 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0
	7	6	5	4	3	2	1	0
1	= 1	13	12	11	10	9	8	7
	7	6	5	4	3	2	1	0
2	= 1	20	19	18	17	16	15	14
	7	6	5	4	3	2	1	0
3	= 1	27	26	25	24	23	22	21
	7	6	5	4	3	2	1	0
4	= 1	34	33	32	31	30	29	28
	7	6	5	4	3	2	1	0
5	= 0	41	40	39	38	37	36	35

Using 7 bytes (containing 49 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0
	7	6	5	4	3	2	1	0
1	= 1	13	12	11	10	9	8	7
	7	6	5	4	3	2	1	0
2	= 1	20	19	18	17	16	15	14
	7	6	5	4	3	2	1	0
3	= 1	27	26	25	24	23	22	21
	7	6	5	4	3	2	1	0
4	= 1	34	33	32	31	30	29	28
	7	6	5	4	3	2	1	0
5	= 1	41	40	39	38	37	36	35
	7	6	5	4	3	2	1	0
6	= 0	48	47	46	45	44	43	42

Using 8 bytes (containing 56 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0
	7	6	5	4	3	2	1	0
1	= 1	13	12	11	10	9	8	7
	7	6	5	4	3	2	1	0
2	= 1	20	19	18	17	16	15	14

	7	6	5	4	3	2	1	0
3	= 1	27	26	25	24	23	22	21
	7	6	5	4	3	2	1	0
4	= 1	34	33	32	31	30	29	28
	7	6	5	4	3	2	1	0
5	= 1	41	40	39	38	37	36	35
	7	6	5	4	3	2	1	0
6	= 1	48	47	46	45	44	43	42
	7	6	5	4	3	2	1	0
7	= 0	55	54	53	52	51	50	49

Using 9 bytes (containing 63 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0
	7	6	5	4	3	2	1	0
1	= 1	13	12	11	10	9	8	7
	7	6	5	4	3	2	1	0
2	= 1	20	19	18	17	16	15	14
	7	6	5	4	3	2	1	0
3	= 1	27	26	25	24	23	22	21
	7	6	5	4	3	2	1	0
4	= 1	34	33	32	31	30	29	28
	7	6	5	4	3	2	1	0
5	= 1	41	40	39	38	37	36	35
	7	6	5	4	3	2	1	0
6	= 1	48	47	46	45	44	43	42
	7	6	5	4	3	2	1	0
7	= 1	55	54	53	52	51	50	49
	7	6	5	4	3	2	1	0
8	= 0	62	61	60	59	58	57	56

Using 10 bytes (containing 64 bit):

	7	6	5	4	3	2	1	0
0	= 1	6	5	4	3	2	1	0
	7	6	5	4	3	2	1	0
1	= 1	13	12	11	10	9	8	7
	7	6	5	4	3	2	1	0
2	= 1	20	19	18	17	16	15	14

3	7 = 1	6 27	5 26	4 25	3 24	2 23	1 22	0 21
4	7 = 1	6 34	5 33	4 32	3 31	2 30	1 29	0 28
5	7 = 1	6 41	5 40	4 39	3 38	2 37	1 36	0 35
6	7 = 1	6 48	5 47	4 46	3 45	2 44	1 43	0 42
7	7 = 1	6 55	5 54	4 53	3 52	2 51	1 50	0 49
8	7 = 1	6 62	5 61	4 60	3 59	2 58	1 57	0 56
9	7 = 0	6 = 0	5 = 0	4 = 0	3 = 0	2 = 0	1 = 0	0 63

References

Used sources of information

- [1] Google Protocol Buffers, https://en.wikipedia.org/wiki/Protocol_Buffers

Standards and specifications

- [2] ISO/IEC/IEEE 60559:2011 Information technology – Microprocessor Systems – Floating-Point arithmetic (which is the successor of IEEE Std 754-2008)
- [3] Google Protocol Buffers <https://developers.google.com/protocol-buffers/docs/encoding>

Sources of sample files

- none -